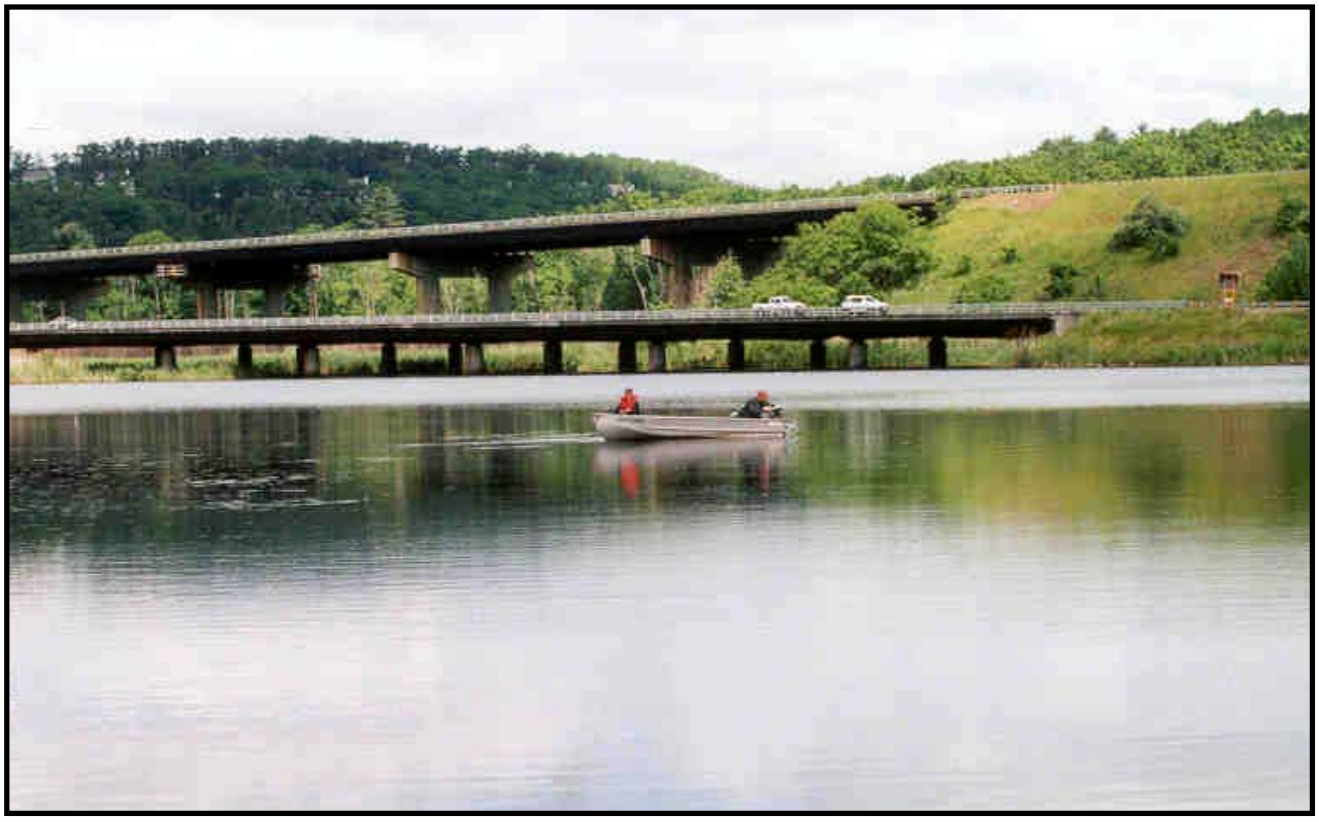
Manchester Urban Ponds Restoration Program

Year 4 Report
2003



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&
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Cover Photo:
Stevens Pond by Art Grindle

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A Note About This Publication

The text from Section II (Water Quality Analysis of Manchester's Urban Ponds) was largely taken from the Volunteer Lake Assessment Program's bi-annual water quality reports. The associated water quality graphs following analysis are taken directly from these reports. Special thank you to Andrea Lamoreaux (VLAP Coordinator) for use of the information in this report.

Introduction

Since 2000, the Manchester Urban Pond Restoration Program (UPRP) has been overseen by the Manchester Conservation Commission (MCC) and has been part of a greater environmental effort in Manchester. As part of a solution to address Manchester's combined sewer overflows (CSOs) and improve environmental conditions within the city, six Supplemental Environmental Projects (SEPs) were implemented. These six projects are: Environmental Education Curriculum Development, Children's Environmental Health Risk Reduction, Stormwater Management, Streambank Stabilization, Land Preservation, and the Urban Ponds Restoration Program. The UPRP was established to assess the condition of seven of Manchester's urban ponds (Crystal Lake, Dorrs Pond, Maxwell Pond, McQuesten Pond, Nutts Pond, Pine Island Pond, and Stevens Pond), and to improve their water quality.

The primary goal of the UPRP is to attempt to return the ponds to their historic uses (such as boating, fishing or swimming). Secondly, the UPRP attempts to promote public awareness, education, and stewardship through watershed meetings, clean ups, newsletters, events, and other educational endeavors. In addition, the UPRP aims to reduce pollutant loading and nutrient inputs and to improve water quality. The UPRP also tries to maintain or enhance biological diversity. Lastly, the UPRP attempts to provide improved recreational uses at each pond.

Manchester's urban ponds are quite different from one another and face unique challenges posed by the urban landscape that surrounds them. To better understand each pond, the UPRP has gathered baseline water quality and biological data over the past four years, and has identified water quality threats and trends at each pond. The current water quality is described in Section IV.

In April, 2002 members of the Manchester Conservation Commission met with the Urban Ponds Restoration Coordinator to discuss pond "goals" and project "prioritization." Each of the seven ponds was discussed at length with regards to potential water quality improvements, outreach/education opportunities, recreational opportunities, land preservation opportunities, and other management tasks. The result is a clearly defined set of goals and prioritized projects within each of the aforementioned categories. The list was recently revised in April 2003 and can be found in Section V. Some specific solutions for the reduction of pollutant inputs include erosion control measures, treatment measures, and proper waste disposal.

For more information on any of these projects, please contact the Urban Ponds Restoration Coordinator at (603) 624-6450 or agrindle@ci.manchester.nh.us or visit http://www.manchesternh.gov/UrbanPonds.

Section I. Work Plan & Areas of Focus for 2003-2004

Section I. Work Objectives (General)

1. **Water Quality:** Gain and report a better understanding of water quality in several parameters at each pond.
2. **Outreach/Education:** Promote community awareness and involvement in Manchester's urban ponds.
3. **Restoration Projects:** Develop, initiate, and complete restoration projects at each pond.
4. **Aesthetics/Recreation:** Remove debris from ponds, work to create/retrofit pond areas as pleasant recreational places.
5. **Partnerships/Visioning:** Establish and work with partners from municipal, state, and federal agencies to ensure program understanding and generate ideas.

Section II. Job Duties (Support Work Objectives)

1. **Water Quality:** Continue collecting data and maintaining a database of pond water quality and biological data. Begin analyzing/interpreting/summarizing/reporting data.
2. **Outreach/Education:** Place more emphasis on outreach/education for the next two years. Enlist help of conservation commissioners and existing environmental groups in town as necessary.
3. **Restoration Projects:** Prioritize and balance pond restoration projects for each pond in three categories: Water Quality Improvement, Outreach/Education, and Recreation. Use pond project table to prioritize/report/plan projects.
4. **Aesthetics/Recreation:** Hold bi-annual pond cleanups, assist Parks & Recreation with conceptual trail work & kiosk construction/retrofit, assist with other activities at each pond.
6. **Partnerships/Visioning:** Work closely with the Manchester Conservation Commission, Planning Department, Environmental Protection Division, SEPP Advisory Committee, and other state and federal officials.

Section III. Key Assignments (Specific)

1. **Water Quality**
   - Continue sampling each pond on a regular basis (at least once a month April-October).
   - Seek out other opportunities for more advanced chemical, biological sampling/surveying (i.e. additional sediment depth sampling, macroinvertebrate sampling, fish surveys, bird surveys, etc).
   - Continue systematically adding data into database and interpreting data.
   - Summarize and report data and trends in a meaningful way so
     i. the stake holders (including Conservation Commission, SEPP and public) can understand and take any appropriate action.
     ii. Restoration projects at the ponds are properly prioritized and carried out
     iii. Summarized data is available for "measureable results" type documents, sampling data and cleanup volumes.

2. **Outreach/Education**
   - Find new and innovative ways to get information out to the public.

- Coordinate a core group of volunteers for pond cleanups and water quality sampling.
- Give presentations at local middle schools, high schools, colleges, and other groups
- Hold other pond activities/events.
- Produce a bi-annual newsletter (Late Spring, Early Fall)
- Create additional fact-sheets for public dissemination.
- Create and update website.
- Create and distribute annual report.
- Keep kiosk materials current.
- Work more closely with media (Union Leader, Hippo Press, WMUR, etc).

3. **Restoration Projects**

- Prioritize and balance pond restoration projects for each pond in three categories: Water Quality Improvement, Outreach/Education, Recreation.
- Utilize "Pond Project Prioritization" table created with Manchester Conservation Commission in January 2002 as a guideline document.
- Solicit input from municipal, state, federal agencies and well as the public.
- Publicize efforts and accomplishments (pond projects, grant monies received, etc).
- Forward communications from CEI and DES relevant to the ponds to Conservation Commission & EPD, to help keep both groups better informed of progress. This assignment will evolve over the year.

5. Aesthetics/Recreation

- Continue holding cleanups, trailwork, other events at each pond.
- Track volumes of trash collected at each pond. Keep good records of volunteers attending and volume/type of trash collected. I.e. 3 bags of trash (mostly paper), 2 tires and 1 refrigerator. Also track partners, ie. trash pickup by City.
- Publicize cleanups and other events via e-mail distribution list, newsletter, website, press releases, flyers at kiosks, etc.

6. Partnerships/Visioning

- Submit weekly progress reports to Conservation Commission (CC: EPD) including major weekly activities for Art and any co-op, meetings (attendees and topics), sampling, cleanups, etc.
- Progress report should also include HELP NEEDED section, which should be a list of things that Art needs advice, help, etc. currently or upcoming.
- Attend information-sharing and collaborative/brainstorming meetings with key partners (Conservation Commission, Environmental Protection Division, Planning Department, SEPP Advisory Committee, Department of Environmental Services, etc)
- Attend SEPP Advisory Committee meetings and Conservation Commission meetings with program updates, items for action, and needed assistance.

- Brainstorm innovative ideas for outreach/education, and new projects.
- Keep Conservation Commission informed of weekly schedule (especially during Summer).
- Create tentative summer sampling/activity schedule and distribute to Conservation Commission.
- Create annual scope, in conjunction with Conservation Commission, with activities planned for each month. Include activities completed in weekly update.
- Meet with direct supervision at least twice per month. With the goal of meeting more often.
- Meet with other Conservation Commission supervisors more frequently/regularly and utilize their skills/experience when needed.
- Attend Planning Board staff meetings with program updates and keep Planning Board administrative assistants aware of your schedule.
- Distribute important documents (ie, outreach/education, newsletters, reports, etc) to Conservation Commission for review

Section II. Outreach & Education Endeavors

Bi-Annual Pond Cleanups (Spring & Autumn)

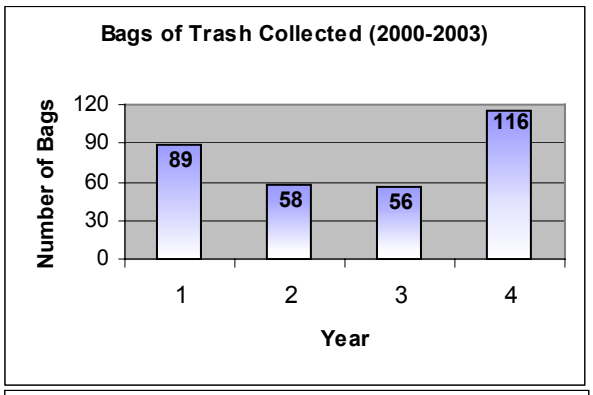
In 2003, the UPRP hosted cleanups at the following ponds: Dorrs Pond, Maxwell Pond, McQuesten Pond, Nutts Pond, and Stevens Pond. All 5 ponds were cleaned once during the spring (May/June), and once during the autumn (September/October) for a total of 10 cleanup events. In total, 51 volunteers spent 118 volunteer hours collecting 116 bags of trash. The value of this volunteer time (per www.independentsector.org) at $17.19/hour equates to $2,028.53.

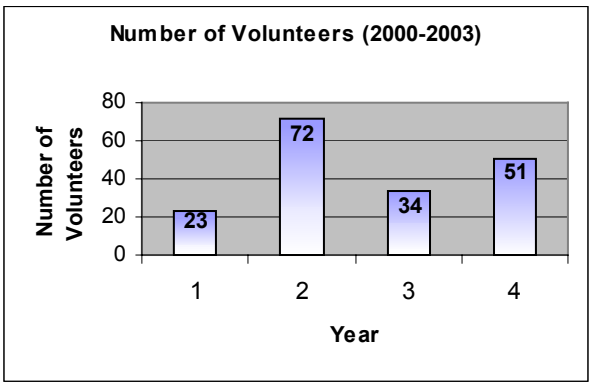
Volunteers at McQuesten Pond. Photo by Jen Drociak

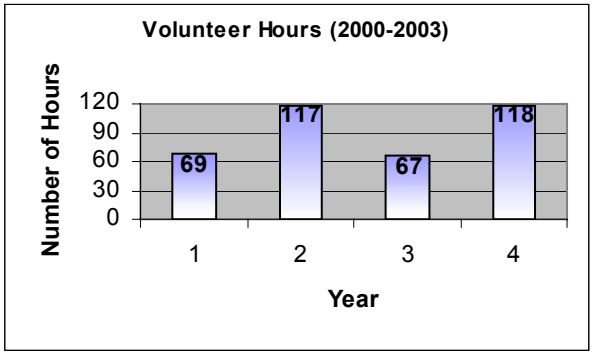
The graphs below depict the following: Top left - total bags of trash collected from 2000-2003; top right – total number of volunteers from 2000-2003; bottom left – total volunteer hours from 2000-2003; and bottom right – volunteer hours per pond 2003.

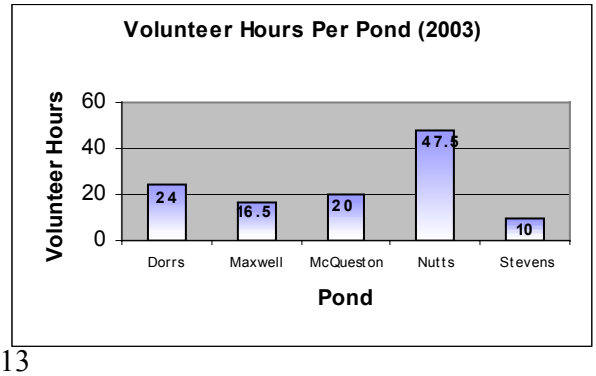
During Year 4 (2003), volunteers collected the most bags of trash, yet the number of volunteers was greatest in 2001. Volunteer hours were the highest in 2003, and 47.5 of those hours were spent at Nutts Pond, where 42 bags of trash were collected.

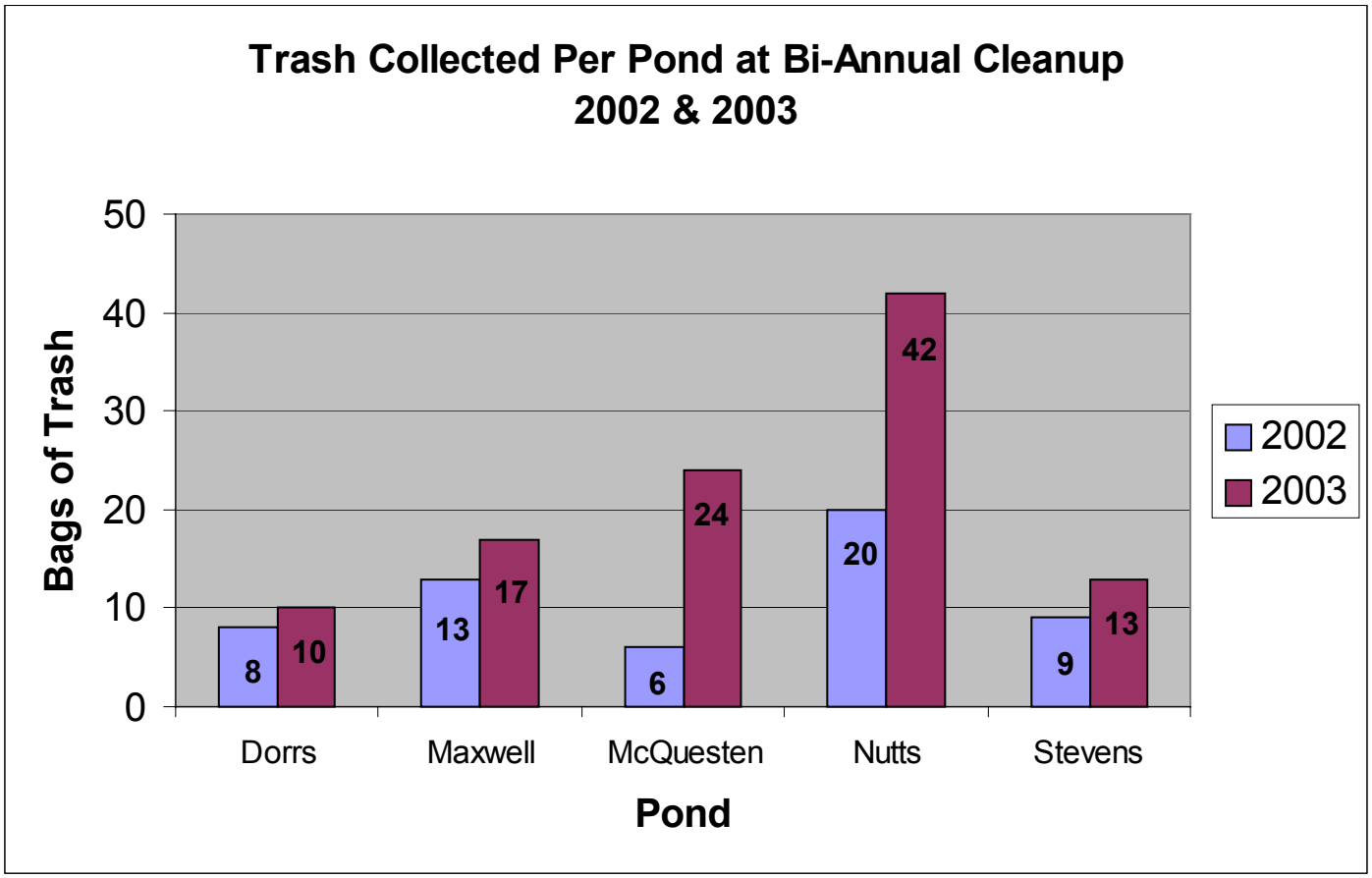
Clean-Up Location	Date of Event	Hours at Event	# Bags Trash Collected	# Volunteers In Attendance	# Volunteer Hours	Value of Volunteer Time ($17.19/hr)
Nutts Pond	4/19/03	3.0	33	8	24	$412.66
Dorrs Pond	5/3/03	2.0	6	9	18	$309.42
Maxwell Pond	5/17/03	3.0	7	2	6	$103.14
McQuesten Pond	5/31/03	3.0	13	5	15	$257.85
Stevens Pond	6/7/03	2.0	9	2	6	$103.14
Dorrs Pond	9/13/03	2.0	4	3	6	$103.14
Maxwell Pond	9/20/03	3.5	10	3	10.5	$180.50
Nutts Pond	10/4/03	2.5	19	11	23.5	$403.97
Stevens Pond	10/11/03	1.0	4	4	4	$68.76
McQuesten Pond	10/18/03	2.0	11	4	5	$85.95
		24	**116**	**51**	**118**	**$2,028.53**

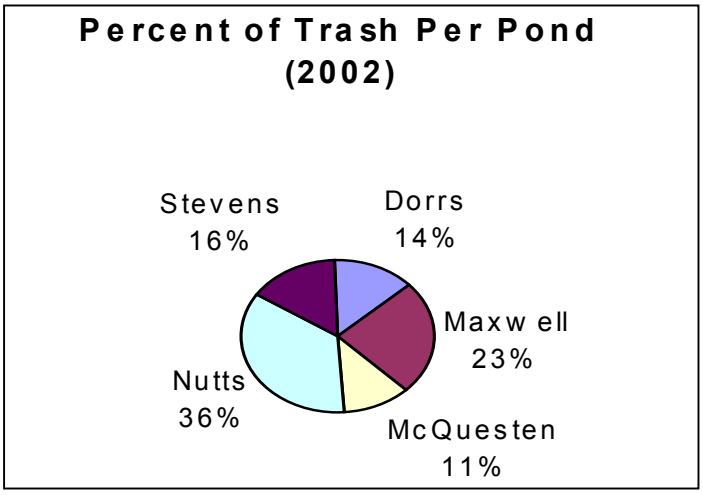


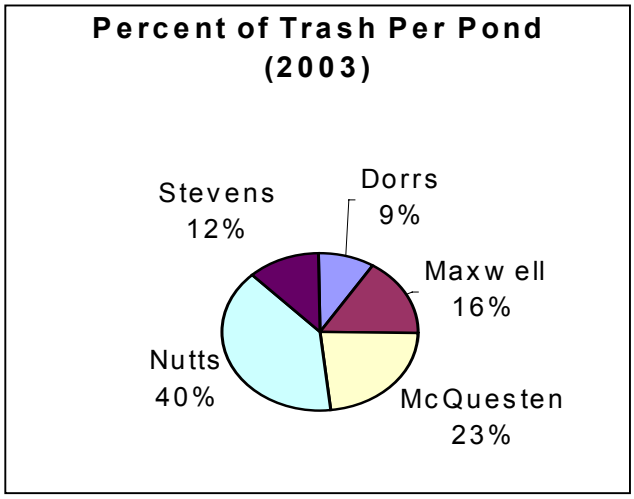












Presentations, "Traveling Display", and Information Dissemination

During 2002, Jen Drociak and Art Grindle spent 10 hours at events with approximately 175 people in total, distributing 103 publications. In 2003, however, Jen and Art spent **18 hours** at events (and also kept the display in several locations unattended), with approximately **975 people** in total, distributing **1,134 publications**. Publications include the UPRP brochure, SEPP brochure, Common Exotic Plant fact-sheets, Common Fish fact-sheets, History fact-sheets, newsletter, clean-up post-cards, and other items. Pencils and magnets were not counted. Following is a description of each event.

April 7, 2003: Jen Drociak and Art Grindle gave a presentation to two sections of an undergraduate ecology class at **St. Anselm's College** in Goffstown. The presentation consisted of an overview of the program, biological and water quality monitoring, outreach and education endeavors, and projects being used to curb further degradation to the urban ponds.

Over **100 students** were at the lecture, and several of them accompanied Art to Nutts Pond for a field trip. A total of **122 UPRP brochures** and **96 SEPP brochures** were distributed at this time.

April 24, 2003: Jen Drociak and Art Grindle gave a presentation at the first annual **"Manchester Earth Day Forum",** which was held at the PSNH Energy Park in Manchester. The event gathered **over 100 attendees**. **204 publications were distributed** and the program peaked the interest of many people. Many SEPP project partners were in attendance, and speakers and organizers of the event included The Nature Conservancy, For Manchester, Merrimack River Watershed Council, Amoskeag Fishways, Camp Dresser & McKee, Manchester Health Department, Hands Across the Merrimack, Manchester Conservation Commission, EPA New England, Manchester Water Works, Manchester Parks & Recreation, Manchester Department of Community Development, Manchester Department of Public Works, Voices & Choices, Queen City Trails Alliance, UNH Cooperative Extension, and Friends of the Valley Cemetary.

May 3, 2003: Jen Drociak took the display to the Amoskeag Fishways **"Fabulous Fishways Carnival"** in Manchester. The UPRP was among several exhibits including the NHDES Rivers Management Program, The Nature Conservancy, NH Fish & Game, Audubon Society, and many local river advisory committees. Jen talked with many people about the UPRP and local ecology of the ponds. **121 publications were distributed**.

June 21, 2003: Jen Drociak gave a presentation at the **NH Lake Association's Annual Congress** in Wolfeboro. The presentation was entitled **"At the End of the Pipe: Issues & Impacts Associated with Urban Waterbodies."** Though only a handful of people attended, it was well received. Senator Judd Gregg was at the event and was interested in hearing about the efforts of the UPRP.

September 1 & 2, 2003: Jen Drociak and Art Grindle attended the first **Mill City Festival** at Arms Park in Manchester. Art and Jen talked with many people at this event and **distributed 360 publications** to passersby.

November 8, 2003: Jen Drociak attended the annual **Rivers & Watershed Conference** in Concord. This event was sponsored by the NHDES and NH Rivers Council. For this event, Jen re-designed the display, and revised all of the UPRP fact sheets. Jen was on the invasive species panel with Bob Estabrook (NHDES Chief Aquatic Biologist), Doug Cygan (NH Department of Agriculture Invasive Species Coordinator), and Lyn Lombard (Piscataquog Watershed Association's Purple Loosestrife Awareness Committee). Jen talked about invasive species projects at Manchester's urban ponds. To view the presentation on-line, visit http://www.des.state.nh.us/rivers/2003Conference/. **109 publications were distributed** at this event.

November, 2003: Also in November, Jen Drociak was a guest on **Manchester Community Television's** (MCTV) history show, **"Early America"** hosted by Richard "R.J" Norton. Jen talked about the history of Crystal Lake, Dorrs Pond, Maxwell Pond, Nutts Pond, and Pine Island Pond. The show aired several times.

November 14 – December 12, 2003: During this time, the display was kept at the **Manchester City Library (East)** and **116 publications were distributed**.

Re-Designed Traveling Display. Photo by Jen Drociak

The table below illustrates the Event/Display Locations for both 2002 and 2003. It also details the date of the event, hours at the event, approximate number of people in attendance at the event, and total number of publications distributed at the event.

Event/Display Location	Date Of Event	Hours At Event	# People In Attendance	# Publications Distributed
2002				
NHACC 32nd Annual	11/2/02	2.5	100	27
DES Rivers & Watershed	11/9/02	6	50	26
Springfield College Ecology Class	12/15/02	1.5	25	50
		10	**175**	**103**

2003

Manchester Chamber of Commerce Visitor Welcome Center		N/A	N/A	50
For Manchester Annual Meeting	2/12/03	4.5	50	6
St. Anselm's College Ecology Class	4/7/03	2	125	218
Manchester Earth Day Forum - PSNH	4/24/03	5	100	204
Amoskeag Fishways Fabulous Fishways Carnival	5/3/03	5	200	121
NH Lakes Association Annual Congress	6/21/03	1		
Mill City Festival - Day 1	9/6/03	5.5	200	189
Mill City Festival - Day 2	9/7/03	8	200	171
Manchester Chamber of Commerce Visitor Welcome Center	10/0/03	N/A		
Manchester City Library East	10/0/03	N/A		
Amoskeag Fishways	10/0/03	N/A		
UNH Manchester	10/0/03	N/A		
DES Rivers & Watershed	11/8/03	5	100	109
Manchester City Library East	11/14/03-12/12/03			116
		18	**975**	**1134**

Mailing List & E-Mail Distribution List

As of June 2004, there are **419** people on the mailing list, and **147** people on the e-mail distribution list. The mailing list is used primarily for the newsletter, while the e-mail distribution list is used several times a year, to distribute the newsletter, and to notify people of upcoming events, program updates, and success stories.

Bi-Annual Newsletter "Pond Possibilities" (Spring & Autumn)

Until 2003, the UPRP newsletter "Pond Possibilities" had been distributed once annually. In 2003, the publication became a bi-annual publication, and was distributed in both the spring (including spring/summer volunteer opportunities and other events) and later summer/early autumn (including autumn/winter volunteer opportunities, other events, and a re-cap of the summer activities. The newsletter is currently distributed to over 400 people citywide. Again, until 2003, the newsletter had only been mailed via the regular mailing list. In 2003, on the back of both issues, it was advertised that the newsletter was also available electronically, instead. Many people took advantage of this, and the newsletter reaches approximately 150 people via the UPRP e-mail distribution list. Both 2003 newsletters can be found in Appendix A.

UPRP Watershed Survey

During the spring of 2003, the UPRP conducted a public awareness survey to better understand public attitudes toward Manchester's urban ponds. With assistance from the University of New Hampshire Survey Center, we designed the survey to tell us what people knew about the ponds, and how they feel the ponds have changed over the years.

2,000 surveys were sent to a randomly selected sample of registered voters in Manchester. It was hoped that 400-500 (20-25%) of the surveys would be returned. The surveys were mailed out in January of 2003. The participants were given two weeks to return the survey in the self-addressed stamped envelope. Out of the 2,000 distributed, those that did not return the survey were sent a duplicate survey and were given an additional two weeks to respond. The entire process took approximately 6 weeks. The UNH Survey Center compiled the data and returned both quantitative and qualitative survey results to UPRP.

The survey consisted of 14 questions. People were asked to describe the condition of the ponds (polluted, clean, etc), and to rate the effectiveness of several possible solutions. Questions were also asked relative to wildlife and volunteer opportunities. Here is what respondents told us:

The majority of those who responded knew the location of 5 of the 7 urban ponds. The same majority, however, did not know the locations of Maxwell or McQuesten Ponds.

- Only 25% of respondents had heard of the UPRP before the survey.

- 69% of respondents knew what a watershed is.
- 28% of respondents thought that Manchester's urban ponds are polluted or very polluted.
- 91% of respondents thought that Manchester's urban ponds are valuable or somewhat valuable for wildlife.
- 80% of respondents thought that Manchester's urban ponds are valuable or somewhat valuable for recreation.
- 70% of respondents had lived in Manchester for more than 20 years, and almost half of respondents were between 40 and 59 years old. The smallest age bracket represented was 18-29 years old at 4%.

The survey will be repeated in 2004 to determine any measurements from our outreach/education endeavors during the last two years. The survey can be found in Appendix B. Additional quantitative data and qualitative analysis can be found on the UPRP website, under publications.

Nutts Pond Pollution Prevention Business Survey

In 2002, the UPRP also created a pollution prevention business survey for facilities within the Nutts Pond watershed. From July through December 2003, 37 (out of 84) businesses in the Nutts Pond watershed were visited. These sites were chosen based on their proximity to Tannery Brook and Nutts Pond.

A few weeks prior to the visits, the businesses were mailed a letter explaining the project. During the visits, the store manager or facilities maintenance person was interviewed. Most businesses visited were assessed on general information (whether they were aware of their proximity to Nutts Pond), solid waste/dumpster maintenance, floor drains, stormwater management, use oil, and use and/or storage of any other hazardous materials.

Most of the businesses were retail establishments that did not produce much solid waste and did have any hazardous product storage or waste(s). All of the businesses surveyed were written a thank-you/follow-up letter, given recommendations for areas which needed improvement, and were also given an UPRP sticker for their window.

Kiosks

During May 2003, Eagle Scout candidate Aaron Biedrzcki constructed 3 new kiosks (Maxwell Pond, McQuesten Pond, and Stevens Pond), and retrofitted three others (Dorrs Pond, Pine Island Pond, Nutts Pond). There are now informational kiosks at each pond. Jen Drociak, Art Grindle, and 2002 intern Lydia Henry created several pond-specific watershed maps, posters, and fact-sheets for the kiosks including information on Common Exotic Plants, Common Fish, History fact-sheets, and nonpoint source pollution. The Eagle Scout project included soliciting donations for construction materials from area businesses, coordinating volunteer construction assistance, and actual construction. The UPRP matched donations of **$1,069.10** to help complete this project.

Website

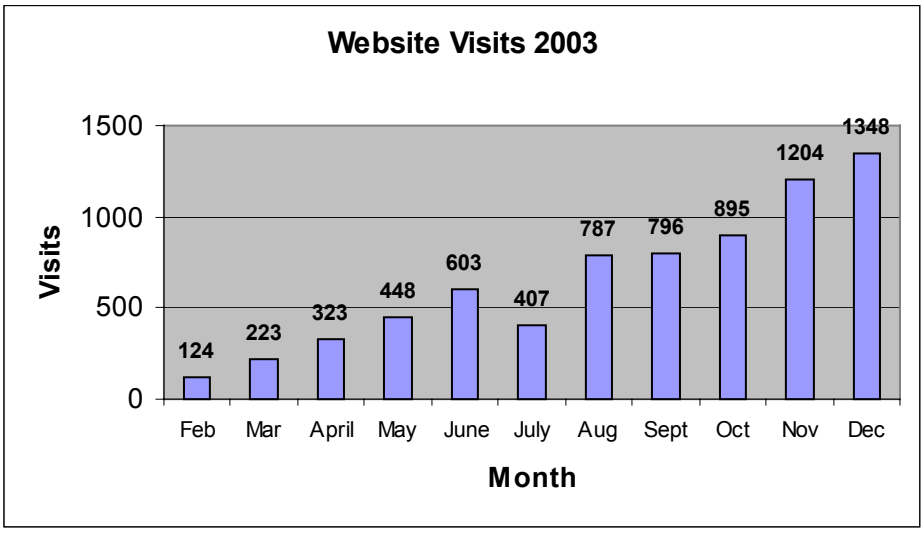
The UPRP website became "live" in February 2003. It contains the following pages: Home, Program Goals & Objectives, Calendar of Events, Publications & Media (containing all UPRP reports, newsletters, fact-sheets, newspaper articles, surveys, and other media), Volunteer Opportunities, Water Quality & Biological Monitoring (including information on water quality monitoring/parameters, fish surveys, vegetation surveys, nonpoint source shoreline surveys, etc), Contact Us, Project Partners & Educational Links, and, a pond-specific page for each of the ponds.

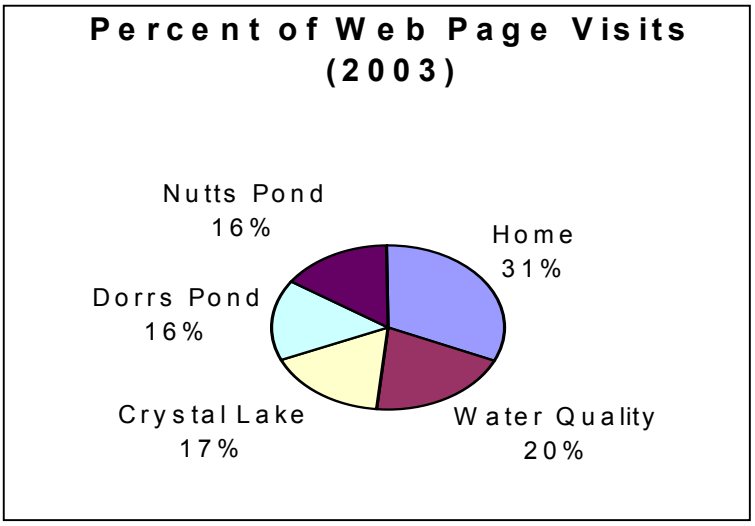
Since February of 2003, we've tracked use of the website through its "visits." A visit is defined as the number of visits that include a view of the specified page. Individual visitors are counted each time they come to the website and are counted only once per visit no matter how many page views they look at.

By viewing the graph below, one can see that visits to the UPRP have been increasing by a wide margin. We are pleased that our outreach efforts and publicity have proven effective in this area. In order to increase additional visits, we are frequently attempting to add something new to the website, therefore keeping it current. One of the most unappealing things we have seen is a "stale" website, where it is never or seldom updated with new and current information.

The table below depicts the how many visits a specific web page has seen per month, since the inception of the website. What are the most popular pages, with the highest average views throughout the year? 1) Home (95 views); 2) Water Quality & Biological Monitoring (59 views); 3) Crystal Lake (51 views); 4) Dorrs Pond (48 views); 5) Nutts Pond (47 views). The website generated an average total of 650 views per month.

Page Name	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	AVG
Home/Pond	26	62	75	74	94	79	103	102	127	155	150	**95**
Pond/Crystal	13	17	24	21	37	75	119	63	64	58	66	**51**
Pond/Dorrs	7	10	20	36	33	19	64	74	75	94	91	**48**
Pond/Maxwell	13	6	11	31	32	19	55	46	57	78	87	40
Pond/McQuesten	8	9	13	24	31	14	50	44	48	71	84	36
Pond/Nutts	9	13	20	49	67	18	59	46	52	89	96	**47**
Pond/Pine Island	9	8	24	26	36	24	59	48	51	80	94	42
Pond/Stevens	9	11	16	21	30	16	49	45	47	79	86	37
Pond/Goals	7	14	12	26	34	11	50	45	45	76	83	37
Pond/Opportunities	6	16	16	20	42	20		61	79	86	104	41
Pond/Events	5	16	22	27	42	27		51	67	82	97	40
Pond/Publications	4	14	14	22	33	19	61	48	53	72	99	40
Pond/Quality	5	12	34	50	56	46	66	74	79	108	118	**59**
Pond/Contact Us	3	15	22	21	36	14	52	49	51	76	93	39
Totals	**124**	**223**	**323**	**448**	**603**	**401**	**787**	**796**	**895**	**1204**	**1348**	**650**





Section II. Sampling Procedures & Laboratory Analysis Costs

The UPRP conducted water sampling at Manchester's seven urban ponds once a month from April through October of 2003. This marked the fourth year of baseline water quality data collection at each pond. Water quality monitoring parameters included temperature, dissolved oxygen, pH, acid neutralizing capacity, conductivity, total phosphorus, chlorophyll-*a* abundance, Secchi disk transparency, and turbidity. A brief explanation of each parameter can be found in the Glossary (Appendix E). Table 2 compares the measured parameters in Manchester ponds to a "typical" NH lake.

Due to occasional equipment difficulties and conflicting schedules, data gaps do exist. Given the different circumstances at each pond, the numbers representing the various parameters may not reflect that pond's water quality condition relative to any other of the ponds studied.

The Department of Environmental Services' (DES) Volunteer Lake Assessment Program (VLAP) sampling procedure was used as a template for these sampling sessions. The detailed procedure for collecting water samples is included in Appendix C.VLAP also created annual water quality reports for each pond and can be viewed by visiting http://www.des.state.nh.us/wmb/vlap/. All water sample analyses (except Total Phosphorus) were performed at the DES Limnology Center and Chemistry Laboratory in Concord, NH. The raw water quality data is included in Appendix D.

In 2003, the DES Limnology Center analyzed 287 water samples free of charge. The UPRP thanks DES for these services, which would have totaled **$2,382.00**.

Table 1: DES Limnology Center Match

Parameter	Number of Samples	Cost Per Sample	Total Cost
Conductivity	99	$6.00	$594.00
Chlorophyll-*a*	28	$20.00	$560.00
pH	31	$6.00	$186.00
ANC	31	$12.00	$372.00
Turbidity	67	$10.00	$670.00
			$2,382.00

Table 2

Comparison of "Typical" New Hampshire Lake Values[1] to Manchester Pond Values[2]

2003 Sampling Season

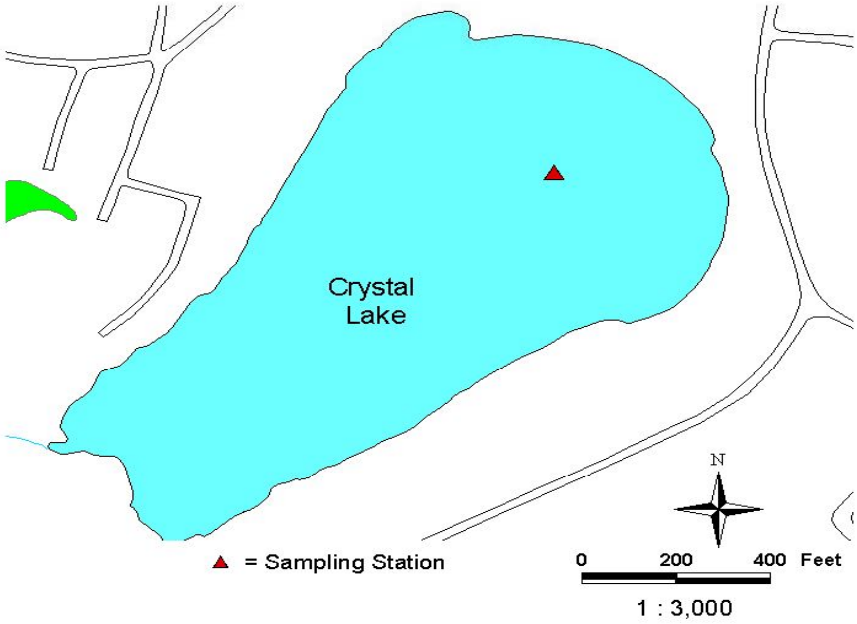
Parameter	# of Lake Stations	Typical NH Lake*		Crystal Lake		Dorr s Pond		Maxwell Pond		Nutts Pond		Pine Island Pond		Stevens Pond	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
PH	780	6.5	6.6	6.88	6.91	7.05	7.13	6.23	6.18	6.68	6.68	6.65	6.65	7.01	7.08
Alkalinity	781	6.6	4.9	18.5	17.4	20.3	16.2	6.4	5.1	17.0	17.5	14.6	16.0	29.2	31.6
Total Phosphorus	772		.012	.010	.010	.024	.023	.018	.018	.030	.029	.029	.033	.017	.017
Conductivity	768	59.4	40.0	473	465	759	783	179.5	171.2	786	790	338.5	364.5	1257.8	1229.5
Secchi Disk	663	3.7	3.2	5.0	4.6	1.7	1.7	>1.1	>1.1	2.3	2.3	1.9	1.8	2.9	2.8
Chlorophyll *a*	776	716	4.58	3.14	3.25	18.03	11.71	1.65	1.63	17.13	11.56	2.21	2.63	4.28	3.65

1) "Typical" values are summer epilimnetic values from DES VLAP.
2) Manchester Pond Values are epilimnetic median and mean values.

Section IV.
Water Quality Monitoring & Status of Manchester's Urban Ponds

Crystal Lake

Figure 1 – Crystal Lake Sampling Stations



Pond Location and Description

Crystal Lake is located off of Corning Road and is the only swimmable pond in Manchester. It is also used for boating, fishing, and is home to numerous lakeside homes and cabins. The goals and projects designed for this water body therefore reflect the pond's important recreational uses.

Water Quality

In general, the water quality in Crystal Lake appears to have improved since sampling was conducted in the early 1980's. The creation of the Crystal Lake Preservation Association (CLPA), which has worked to improve the health of the lake, may be at least partially responsible for the reduction of phosphorus and algae concentrations.

Crystal Lake Beach. Photo by Cyndy Carlson

Chlorophyll-*a*

Composite values for chlorophyll-*a* for the upper 3 meters ranged from 1.23 to 4.95 milligrams/cubic meter (mg/m^3), with a median of 3.25 mg/m^3. Chlorophyll-*a* concentrations have not significantly changed since monitoring began in 2000.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcome. In New Hampshire's freshwater lakes/ponds, phosphorus is the limiting nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is an increase in nonpoint sources of phosphorus loading from

the watershed, or in-lake sources of phosphorus loading (such as phosphorus released from the sediments). It is important to continually educate residents about how activities within the watershed can affect phosphorus loading and lake quality, (i.e. excessive lawn fertilization and unmanaged pet wastes).

Conductivity

Conductivity in the epilimnion (top layers) ranged from 457 to 497 uMhos/cm, with an average of 473 uMhos/cm. The conductivity has consistently increased in the lake since monitoring began in 2000.

Dissolved Oxygen (DO)

The dissolved oxygen concentration was low in the hypolimnion (bottom layers) at the deep spot of the lake on all sampling events. As stratified lakes age, oxygen becomes depleted in the hypolimnion. In addition, depleted oxygen concentration in the hypolimnion of thermally stratified lakes (cold bottom layer, warmer top layer) typically occurs as the summer progresses. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion the phosphorus that is normally bound up in the sediment may be re-released into the water column

pH and Acid Neutralizing Capacity (ANC)

The mean pH at the deep spot this season ranged from 6.64 in the hypolimnion to 6.99 in the epilimnion (upper layer), which means that the water column ranges from being slightly acidic near the bottom of the lake to being neutral near the surface.

The Acid Neutralizing Capacity (ANC) of the epilimnion continues to remain high (18.5 mg/L as $CaCO_3$) and is much greater the state mean of 6.7 mg/L (Table 5). Specifically, this means that the lake/pond has a “low vulnerability” to acidic inputs (such as acid precipitation)

Phosphorus (TP)

The total phosphorus concentration measured in the epilimnion of Crystal Lake ranged from 0.009 to 0.012 mg/L, with a mean of 0.010 mg/L.

The current year data for the epilimnion (see Figure 1) show that the total phosphorus concentration increased from May to June, and then decreased from June to September.

The historical data show that the 2003 mean epilimnetic total phosphorus concentration is slightly lower than the state mean.

The current year data for the hypolimnion show that the total phosphorus concentration remained steady early in the season, then increased by September.

The historical data show that the 2003 mean hypolimnetic total phosphorus concentration is greater than the state mean.

Overall, the statistical analysis of the historical data show that the total phosphorus concentration in the epilimnion and the hypolimnion has not significantly changed since monitoring began in 1993. Specifically, the total phosphorus concentration in the epilimnion and hypolimnion has varied, but has not continually increased or decreased since monitoring began.

Transparency

Secchi disk transparency ranged from 4.45 to 5.95 meters, with a median of 4.55.

The current year data (see Figure 2) show that the in-lake transparency increased from May to June this season. The transparency consistently remained greater than the state mean.

The historical data show that the 2003 mean transparency is greater than the state mean.

Overall, the statistical analysis of the historical data show that the mean annual in-lake transparency has not significantly changed since monitoring began in 1993. Specifically, the in-lake transparency has remained relatively stable and has ranged between approximately 3.5 to 4.6 meters.

Turbidity

Turbidity in Crystal Lake hypolimnion ranged from 0.72 to 3.02 with an average of 1.63 (NTU). Turbidity levels in the epilimnion of Crystal Lake have doubled each year since 2000 until 2003 when they were significantly reduced.

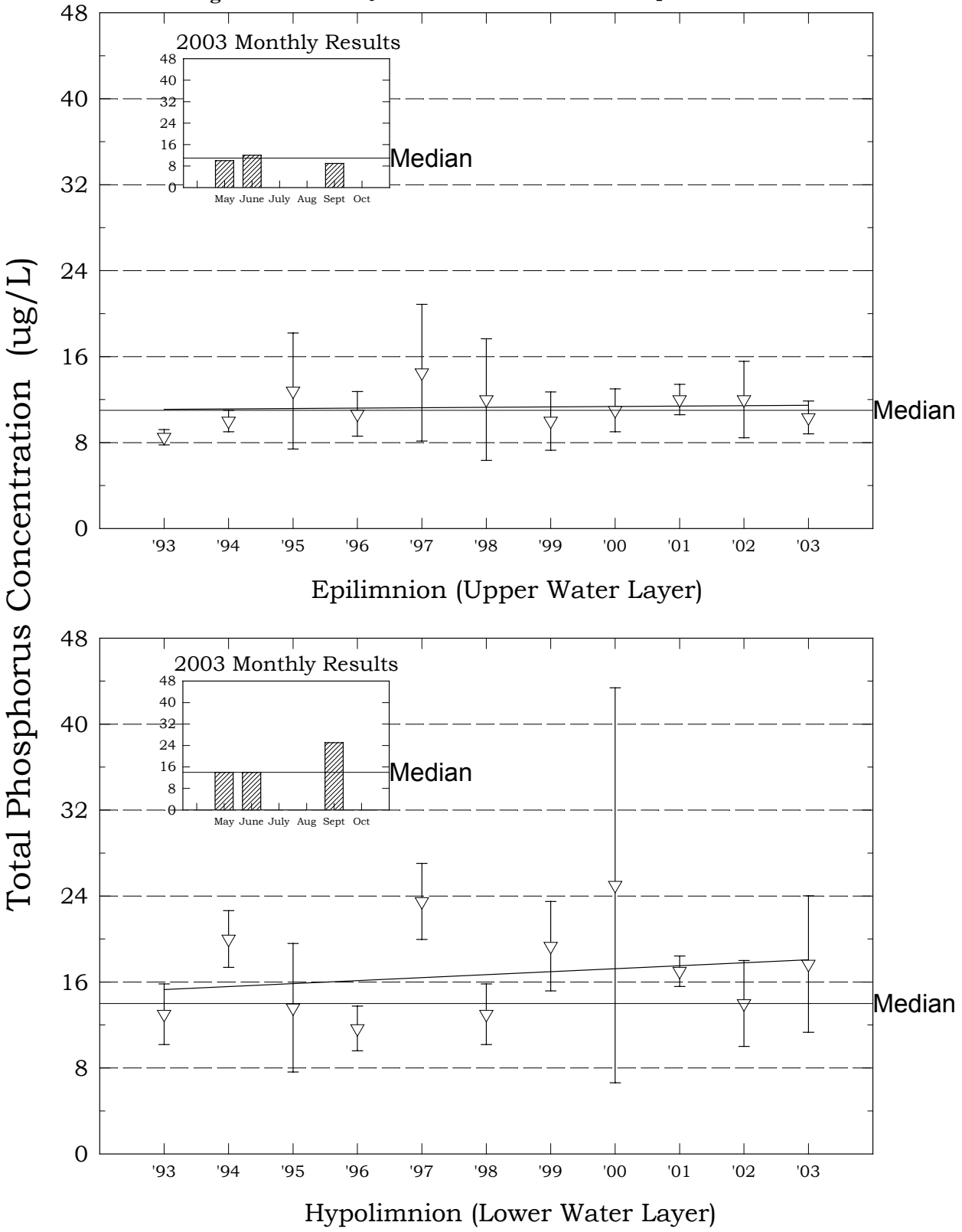
Table 2[1]
Comparison of Crystal Lake – 1981*, 1985, 1997[+] & 2000 – 2003**

Parameter	7/14/81	1985 Median	6/30/97	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
pH	7.3	7.2	7.1	6.99	6.94	7.09	7.09	7.07	7.07	6.88	6.91
Alkalinity (mg/l)	21.9	20.8	16.1	18.1	18.8	17.3	16.0	20.2	17.7	18.5	17.4
Total Phosphorus (mg/l)	0.043	0.02	0.019	0.011	0.011	0.012	0.012	0.012	0.013	0.010	0.01
Conductivity (uMhos/cm)	317	316	342	418.7	418.0	439.7	444.0	443.8	442.5	473	465
Secchi Disk (m)	2.0	3.0	4.5	4.3	4.5	3.5	3.5	3.9	4.2	5.0	4.6
Chlorophyll-*a* (mg/m3)		22.17		3.39	2.72	4.75	5.10	2.64	2.64	3.14	3.25

1) All values are epilimnetic values, except chlorophyll-*a* which is a composite of measurements taken at several depths.
* NH Dept. of Environmental Services. 1981. Trophic Classification of NH Lakes and Ponds.
** Estabrook, R., et al. 1985. Urban Lakes Diagnostic/Feasibility Study. Staff Report No. 140. New Hampshire Water Supply and Pollution Control Commission.
\+ NH Dept. of Environmental Services. 1998. Lake Trophic Data.

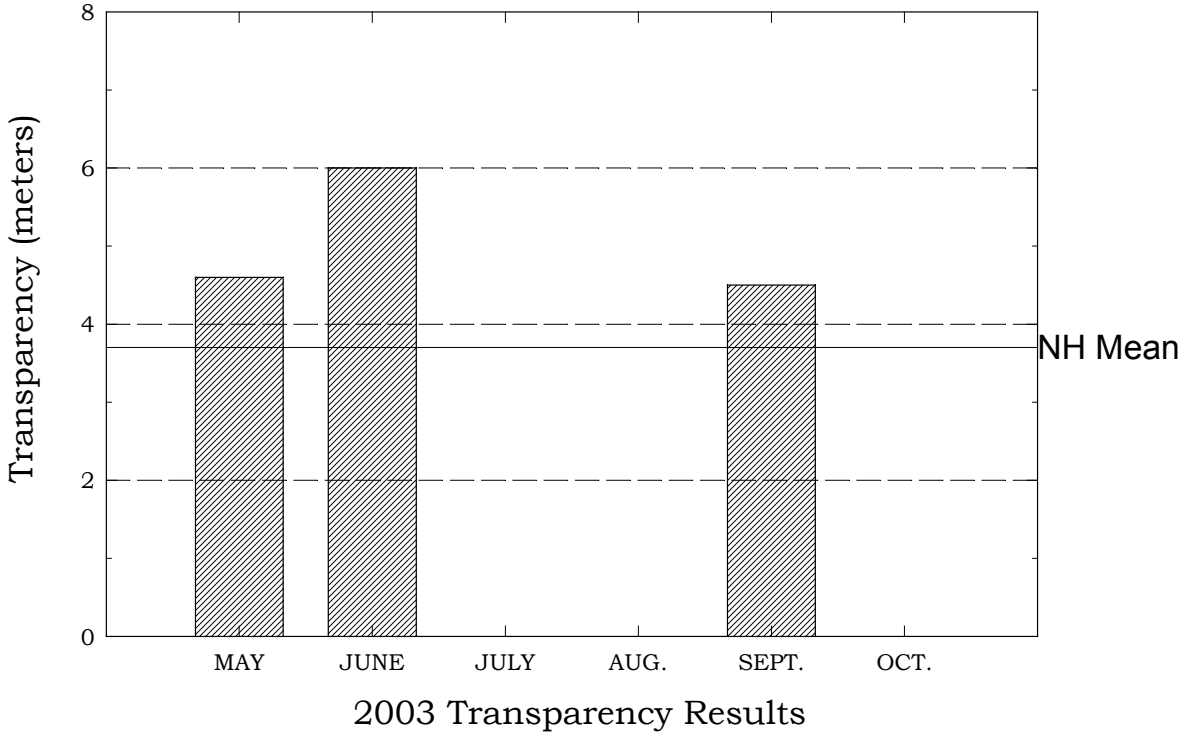
Crystal Lake, Manchester

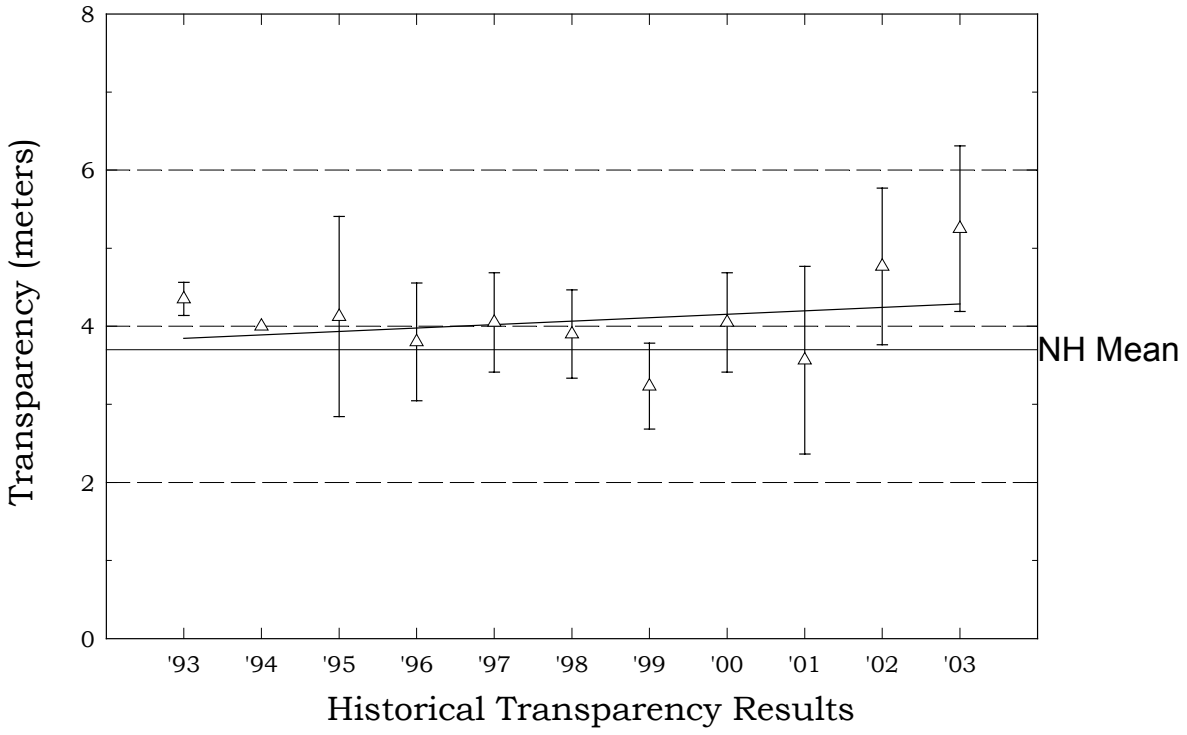
Figure 1. Monthly and Historical Total Phosphorus Data.



Crystal Lake, Manchester

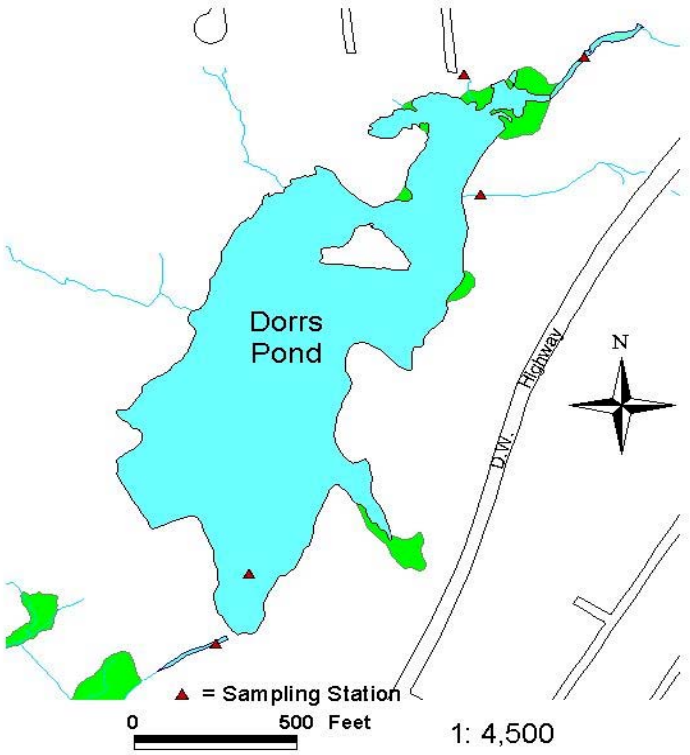
Figure 2. Monthly and Historical Transparency Results





Dorrs Pond

Figure 2 – Dorrs Pond Sampling Stations



Pond Location and Description

Dorrs Pond is a very important recreation spot in Manchester. It is used for passive recreation such as hiking and biking. Fishing and ice skating are two other common recreational activities. The goals and projects designed for this water body therefore reflect the pond's recreational uses.

Dorrs Pond. Photo by Cyndy Carlson

Water Quality

The overall water quality of Dorrs Pond has not significantly changed over the last twenty years, though it is slightly more degraded now. Conductivity has increased greatly, but phosphorus and chlorophyll-*a* levels seem to have decreased. The approximately 134 acres of city-owned forested woodland which surrounds the pond has prevented pondside development, thus providing the pond a reprieve from receiving any more direct urban runoff than it historically has.

Chlorophyll-*a*

Composite values for chlorophyll-*a* for the upper 1.5 meters ranged from 8.20 to 34.18 mg/m^3, with a median of 11.71 mg/m^3. This was lower than the 1985 DES findings, where the median was 38.84 mg/m^3 and also lower than the 2000 and 2001 readings. These numbers represent an increase since 2002 however. These readings indicate a productive water body, (i.e. a water body with substantial plant growth). DES considers concentrations greater than 15 mg/m^3 to be a nuisance amount that is indicative of an algal bloom. Composite samples are derived from combining water samples from each meter of the water column from the midpoint of the metalimnion (middle layer) to the surface.

The current year data (see Figure 3) show that the chlorophyll-a concentration increased through the season.

The historical data show that the 2003 chlorophyll-a mean is greater than the state mean.

Overall, visual inspection of the historical data shows consistent variation in-lake chlorophyll-a, meaning that the concentration has fluctuated since monitoring originally began in 1996. It is worthy to note that the mean annual chlorophyll-concentration has steadily decreased from 2000 to 2002. 2003 represents an increase.

Conductivity

Conductivity in the epilimnion ranged from 663 to 831 uMhos/cm, with a mean of 759 uMhos/cm. When the pond was stratified, the hypolimnion conductivity measured 782 uMhos/cm. This is a slight decrease from 2002, but still almost twice the conductivity levels recorded in 2000. As expected, the inlets also were highly conductive, averaging 1162 and 1014 uMhos/cm each. These are very high conductivity levels, most likely caused by the large amount of urban runoff that this location receives. Mean conductivity levels have risen significantly since 1985.

Dissolved Oxygen (DO)

Hypolimnion dissolved oxygen readings varied greatly from month to month at Dorrs Pond. This may be due to the shallow area in which readings were taken. The sampling station is relatively close to the dam/outlet which creates a current in this area. Factors influencing pond flow, such as precipitation, may also influence dissolved oxygen concentration in this particular area. As in past years, summer dissolved oxygen levels were depleted in the hypolimnion but levels were more uniform throughout the water column during the spring and fall.

The dissolved oxygen concentration was consistently low in the hypolimnion at the deep spot of the pond, but not terribly depleted. As stratified lakes/ponds age, oxygen becomes depleted in the hypolimnion (the lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion, the phosphorus that is normally bound up in the sediment may be re-released into the water column.

pH and Acid Neutralizing Capacity (ANC)

The pH of Dorrs Pond ranged from 6.84 to 7.17, with an average of 7.05. pH values in the 1985 DES study were not significantly different than those taken from 2000 through 2003. The 1985 median was 7.0. Alkalinity, or Acid Neutralizing Capacity (ANC) ranged from 14.0 to 30.6 mg of CaCO/L, with an average of 20.3 mg/L in 2002. This is an increase 2000, but remains consistent with 2001 and 2002. The 1985 DES alkalinity median value was 15.4 mg/L of CaCO.

The Acid Neutralizing Capacity (ANC) of the epilimnion continued to increase this season and is much greater than the state mean of 6.7 mg/L (Table 5). Specifically, this means that the pond is “not vulnerable” to acidic inputs (such as acid precipitation).

Total Phosphorus (TP)

The total phosphorus concentration (TP) measured in the epilimnion of Dorrs Pond varied from .023 to .026 mg/L, with a mean of .024 mg/L. This is a slight increase from TP levels measured in 2002. When the pond was stratified, TP in the lower level or hypolimnion only reached 0.022 mg/L. Two of the pond's main inlets are still significant sources of phosphorus input, even with apparent reduction from last year. Lessard's Brook averaged 0.077 mg/L of TP and Inlet 2 East averaged 0.014 mg/L of TP. The '81-'82 DES study found a median of .042 mg/L TP in the epilimnion.

The current year data (Figure 4) for the epilimnion show that the total phosphorus concentration increased through the season. The total phosphorus concentration on each sampling event was greater than the state median.

The current year data for the hypolimnion show that the total phosphorus concentration was only measured in August and was much greater than the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows relatively stable total phosphorus trend since monitoring began in 1996.

Transparency

Secchi disk transparency ranged from 1.4 to 2.1 meters, with a median of 1.7 meters. The minimum transparency was recorded in August. Water clarity and chlorophyll-*a* concentrations seem to be somewhat related since water clarity and chlorophyll *a* have both worsened since 2002.

The current year data show that the in-lake transparency decreased through the season.

Overall, visual inspection of the historical data trend line (see Figure 5) shows a stable trend for in-lake transparency, meaning that the transparency has been approximately the same since monitoring began in 1996.

Turbidity

Turbidity of epilimnion samples ranged from 2.57 to 4.6 (NTU), with an average of 3.42 (NTU) in 2003. High turbidity is most likely caused by a large volume of urban runoff to this location. Turbidity measurements were not taken at Dorrs Pond during the 1985 DES Diagnostic/Feasibility Study.

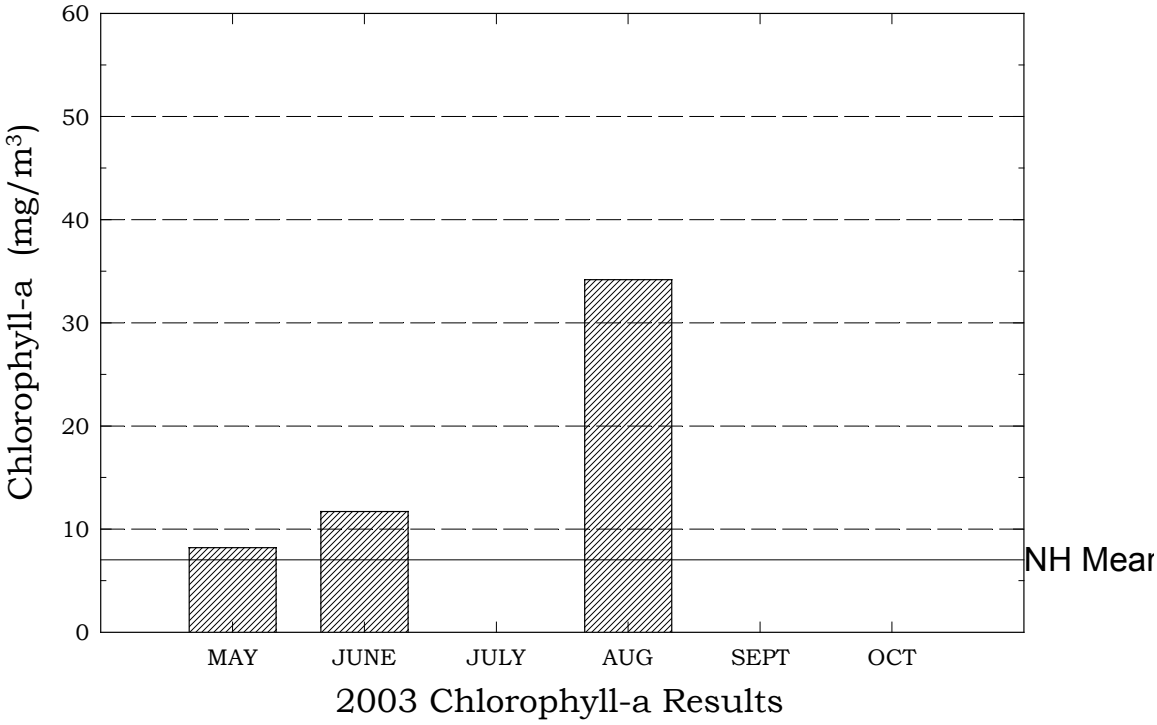
Table 4[1]
Comparison of Dorrs Pond – 1981*, 1985, 1997[+], 2000 – 2003**

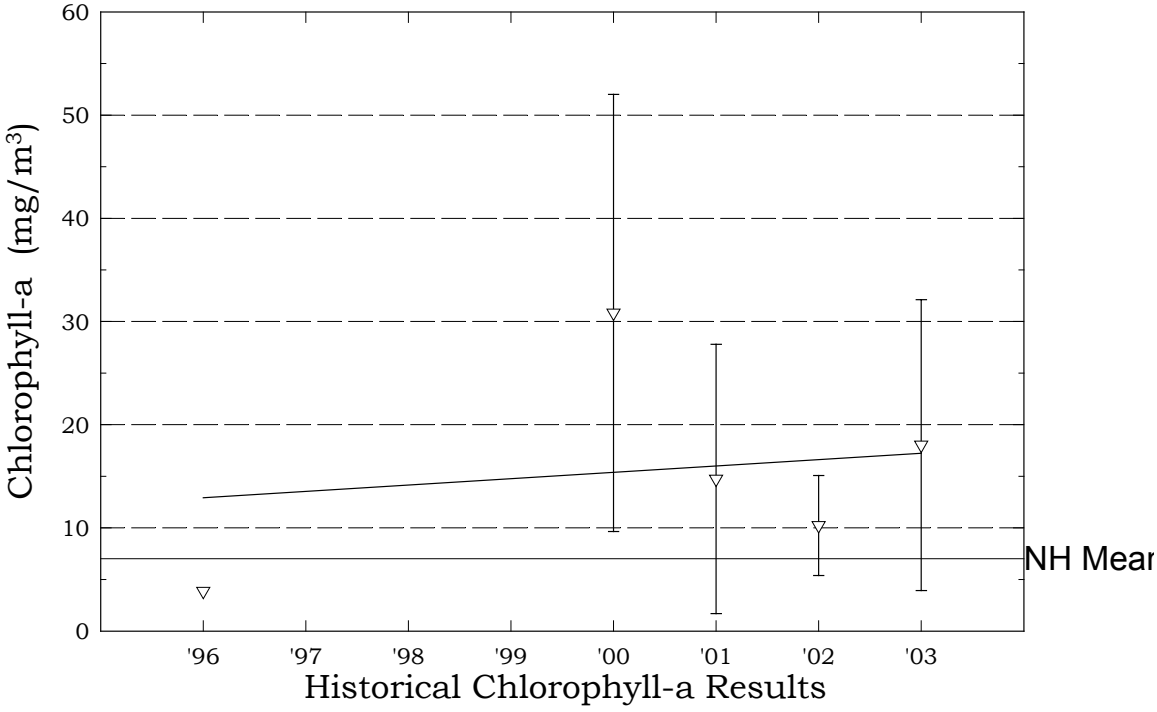
Parameter	7/14/81	1985 Median	7/17/97	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
PH	6.8	7.0	7.1	7.08	7.08	7.15	7.09	7.07	7.07	7.05	7.13
Alkalinity (mg/l)	13.9	15.4	22.2	16.2	--	21.7	21.9	26.5	26.5	20.3	16.2
Total Phosphorus (mg/l)	0.060	0.042	0.031	0.045	--	0.024	0.024	0.021	0.021	0.024	0.023
Conductivity (uMhos/cm)	201	258	469	408	--	831.3	851.0	882.6	899.0	759	783
Secchi Disk (m)	1.3	1.6	1.3	1.1	1.0	1.3	1.1	2.0	2.0	1.7	1.7
Chlorophyll-*a* (mg/m3)	--	38.84	--	30.84	--	14.75	9.74	8.40	8.72	18.03	11.71

1) All values are epilimnetic, except chlorophyll-*a* which is a composite.
* NH Dept. of Environmental Services. 1981. Trophic Classification of NH Lakes and Ponds.
** Estabrook, R., et.al. 1985. Urban Lakes Diagnostic/Feasibility Study. Staff Report No. 140. New Hampshire Water Supply and Pollution Control Commission.
[+] NH Dept. Of Environmental Services. 1998. Lake Trophic Data.

Dorrs Pond, Manchester

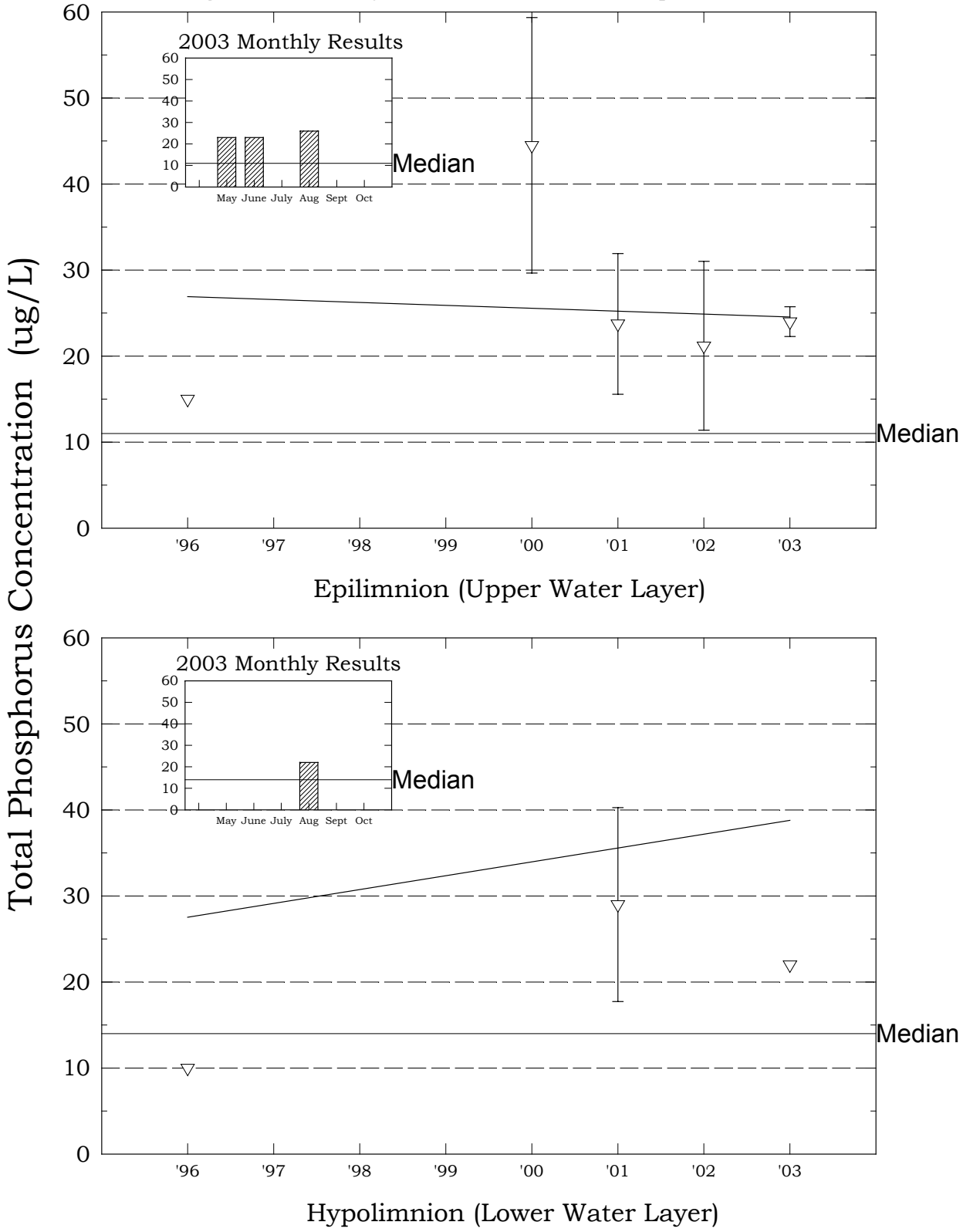
Figure 3. Monthly and Historical Chlorophyll-a Results





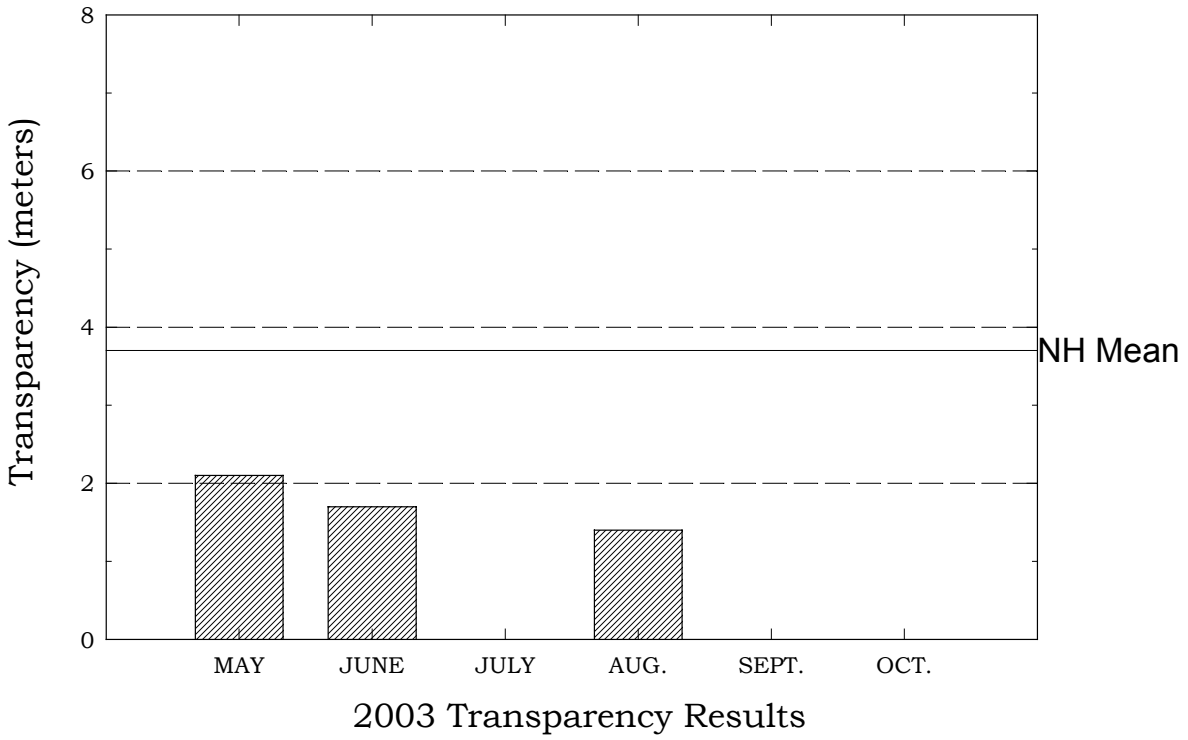
Dorrs Pond, Manchester

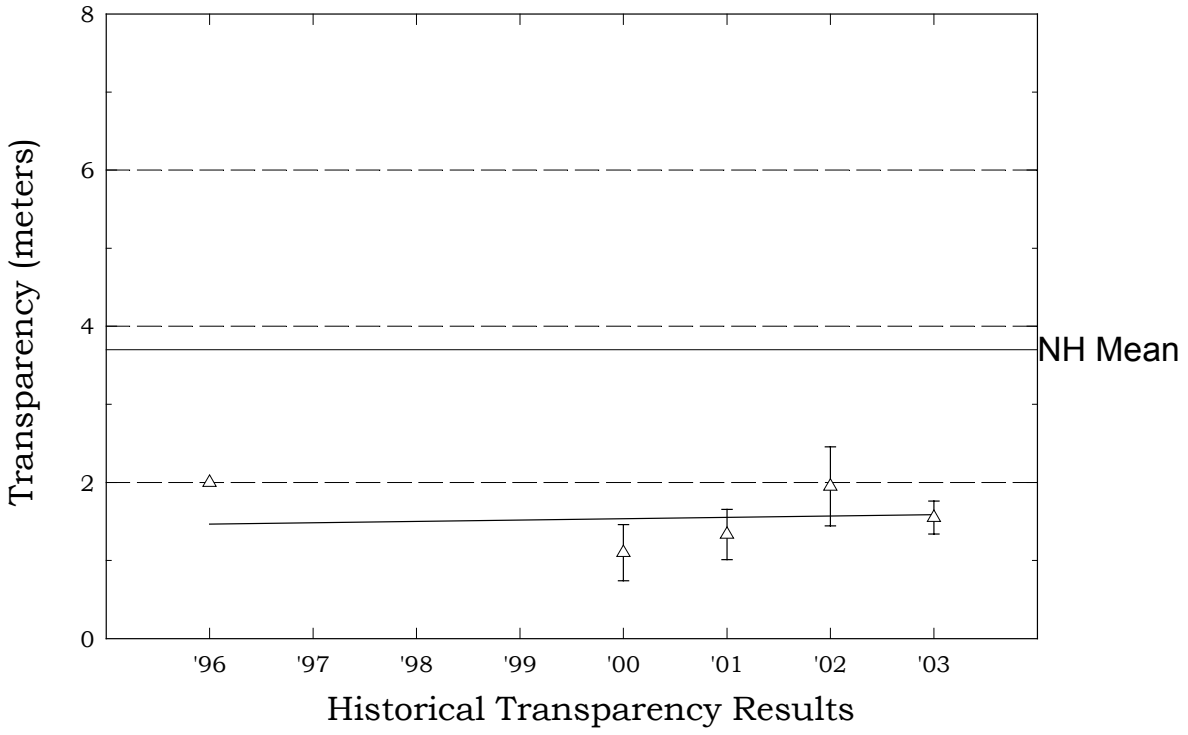
Figure 4. Monthly and Historical Total Phosphorus Data.



Dorrs Pond, Manchester

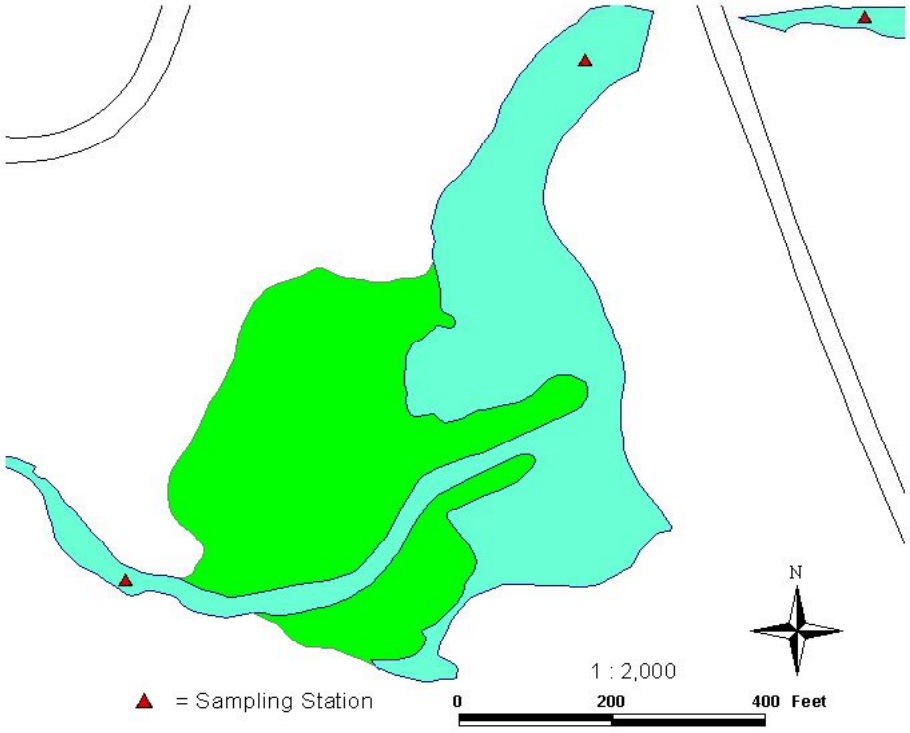
Figure 5. Monthly and Historical Transparency Results





Maxwell Pond

Figure 6 – Maxwell Pond Sampling Stations



Pond Location and Description

Maxwell Pond, located on Front Street at the intersection of Dunbarton Road, is formed as an impoundment of Black Brook. It is used for fishing, hiking, and education. A trail system encircles the pond, and a playground is located by the dam on Front Street.

Water Quality

The water quality of Maxwell Pond is better than any other Manchester Pond. Maxwell Pond has a very high turnover rate and relatively little urban development in the watershed. Its stream-like characteristics allow most nutrients to wash downstream. However, rapid sedimentation (due to the dam) and vegetation growth is occurring in some parts of the pond.

Chlorophyll-*a*

Chlorophyll-*a* concentrations were very low, ranging from 0.66 to 2.70 mg/m^3, and averaging 1.65 mg/m^3. These low readings are most likely due to the pond's high flushing rate.

Autumn at Maxwell Pond. Photo by Ron Johnson

The current year data (see Figure 7) show that the chlorophyll-*a* concentration fluctuated throughout the season. The historical data show that the 2003 chlorophyll-*a* mean is less than the state mean.

Overall, visual inspection of the historical data trend line shows a stable in-lake chlorophyll *a* trend, meaning that the concentration has remained approximately the same since monitoring began in 2000.

Conductivity

Conductivity of Maxwell Pond ranged from 125.8 to 250.0 uMhos/cm, with an average of 179.5 uMhos/cm. DES 1981 data shows conductivity at 56.0 uMhos/cm. Inlet samples ranged from 125.6 to 255.0 uMhos/cm and averaged 180.4 uMhos/cm in 2003.

The conductivity in the pond and in the inlet is relatively high. Typically conductivity levels greater than 100 uMhos/cm indicate the influence of human activities on surface water quality. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources such as iron deposits in bedrock, can influence conductivity.

Dissolved Oxygen (DO)

Dissolved oxygen levels are consistently high in relation to other Manchester ponds due to the stream-like characteristics of Maxwell Pond. The lowest dissolved oxygen saturation recorded at Maxwell Pond was 44.0% at the pond's deepest point. DO levels in 2003 were very similar to those found in prior years.

pH and Acid Neutralizing Capacity (ANC)

The pH at the deep spot this season ranged from 5.97 to 6.61 in the epilimnion, which means that the water is slightly acidic. pH readings at Maxwell Pond have been similar throughout the past four years of sampling. The values are slightly low for NH freshwater ecosystems, but still well within the range for supporting aquatic life. pH readings by NH DES in 1981 were similar at 6.4. ANC was also consistently lower than other Manchester ponds, ranging from 2.0 to 13.5 mg of CaCO/L, with an average of 6.4 mg/L. In 1981, NH DES found ANC to be 6.4 mg/L. Maxwell is therefore less able to buffer acidic inputs, which may help explain the low pH readings. This is slightly lower than the state mean of 6.7 mg/L. Specifically, this means that the lake/pond is "moderately vulnerable" to acidic inputs (such as acid precipitation).

Total Phosphorus (TP)

Due to the fact that the deepest spot in Maxwell Pond is 1.1 meters, there was no thermal stratification, so only "surface grab" samples were necessary for in-pond sampling. Total phosphorus concentrations ranged from 0.012 to 0.022 mg/L, with an average of 0.018 mg/L. Due to the high turnover of pond volume and shallowness here, inlet samples are especially important. TP concentrations in the inlet samples (Black Brook) peaked at 0.018 mg/L and averaged 0.015 mg/L.

The current year data (see Figure 8) show that the total phosphorus concentration increased overall from May to June, then remained stable for the rest of the season. The total phosphorus concentration was greater than the state median on each sampling event expect for the May event.

The historical data show that the 2003 mean epilimnetic total phosphorus concentration is greater than the state median.

Overall, visual inspection of the historical data trend line show a stable total phosphorus trend.

Transparency

As the bottom could clearly be seen at 1.1 meters, Secchi disk transparency was greater than 1.1 meters and could not be measured more accurately due to lack of depth. The transparency was greater than the pond depth, i.e. one can see the pond bottom. The Secchi-disk was visible on the bottom of the pond on each sampling event.

Since the transparency can not be accurately measured due to the shallowness of the pond, it isn't possible to determine a trend.

Turbidity

Turbidity in Maxwell Pond ranged from 1.58 to 4.01 (NTU) and averaged 2.57 (NTU). NH DES 1981 turbidity readings were a bit higher at 4.3 (NTU).

Maxwell Pond water quality has remained consistent since 2000, with the exception of conductivity which has increased. Four years of data, however, do not accurately represent a trend. Natural fluctuations, upstream disturbances and discharges, and precipitation variations could all be singled out as reasons for water quality fluctuations.

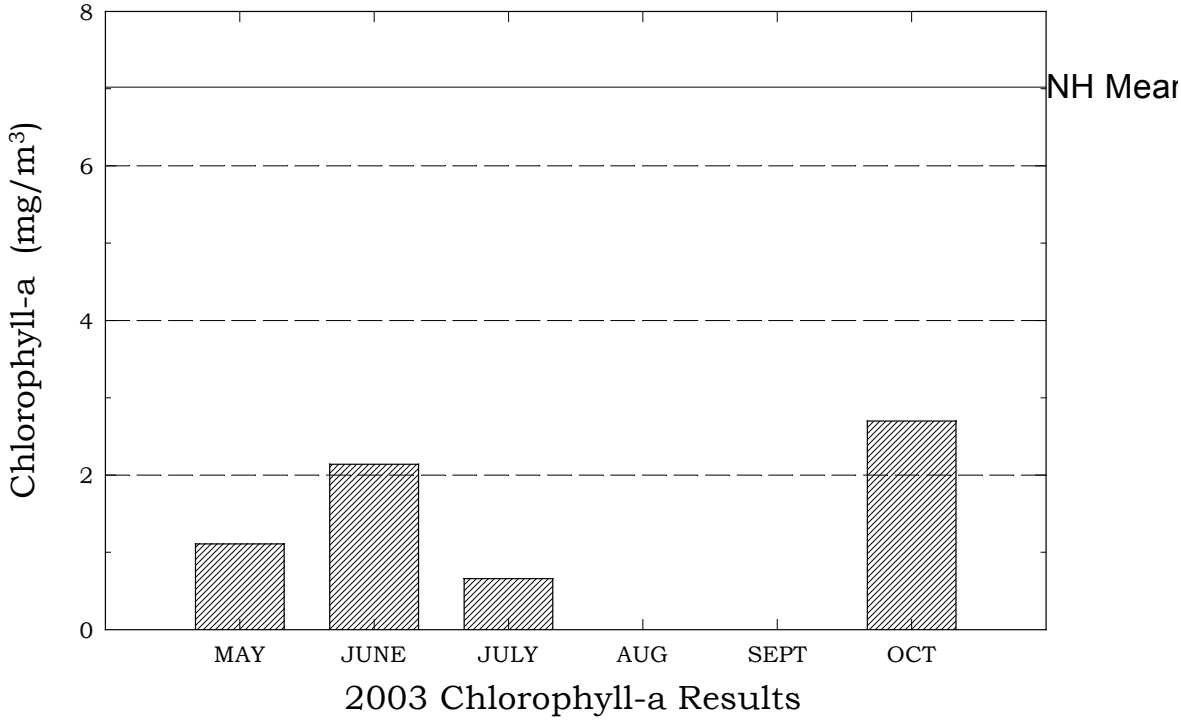
Table 5[1]
Comparison of Maxwell Pond – 1981*, 2000 – 2003

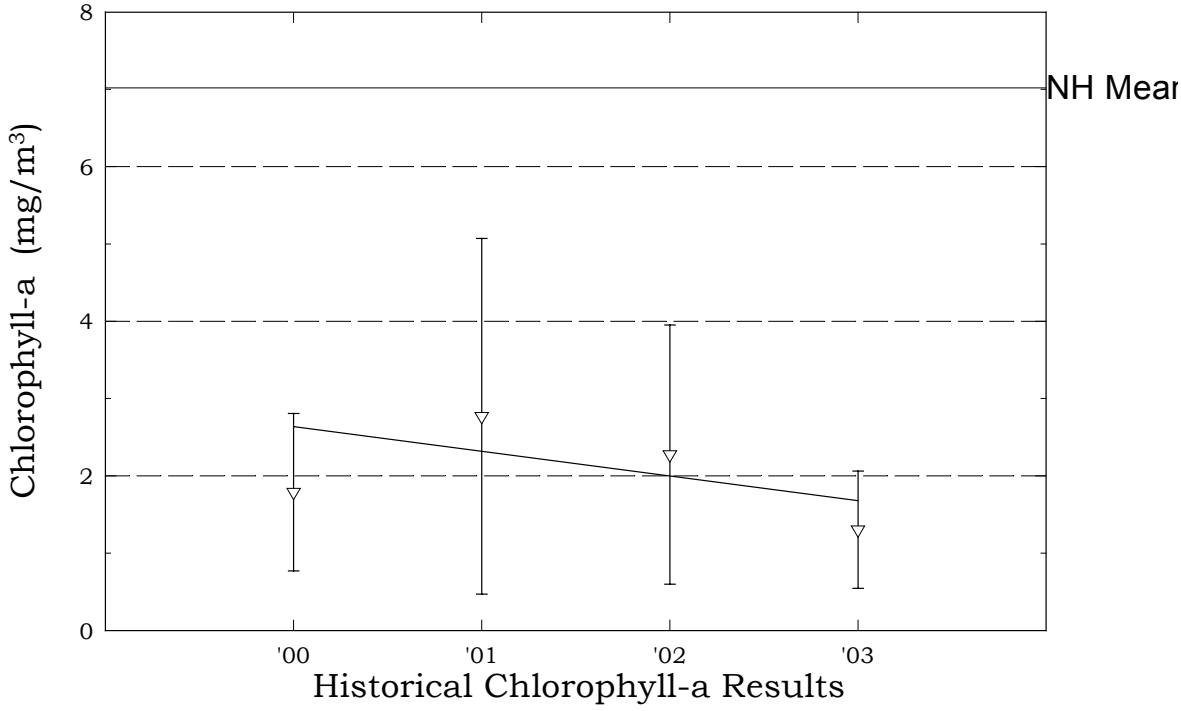
Parameter	1981	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
pH	6.4	6.54	6.55	6.63	6.62	6.50	6.52	6.23	6.18
Alkalinity (mg/l)	7.0	6.8	6.9	9.8	9.6	6.74	3.6	6.4	5.05
Total Phosphorus (mg/l)	0.018	0.014	0.014	0.018	0.018	0.015	0.016	0.017	0.018
Conductivity (uMhos/cm)	56.0	121.8	127.3	154.6	148.5	201.4	147.8	179.5	171.2
Secchi Disk (m)	>1.2	>1.1		>1.1		>1.1		>1.1	
Chlorophyll-*a* (mg/m3)		1.55	1.07	3.17	4.01	1.68	1.68	1.65	1.63

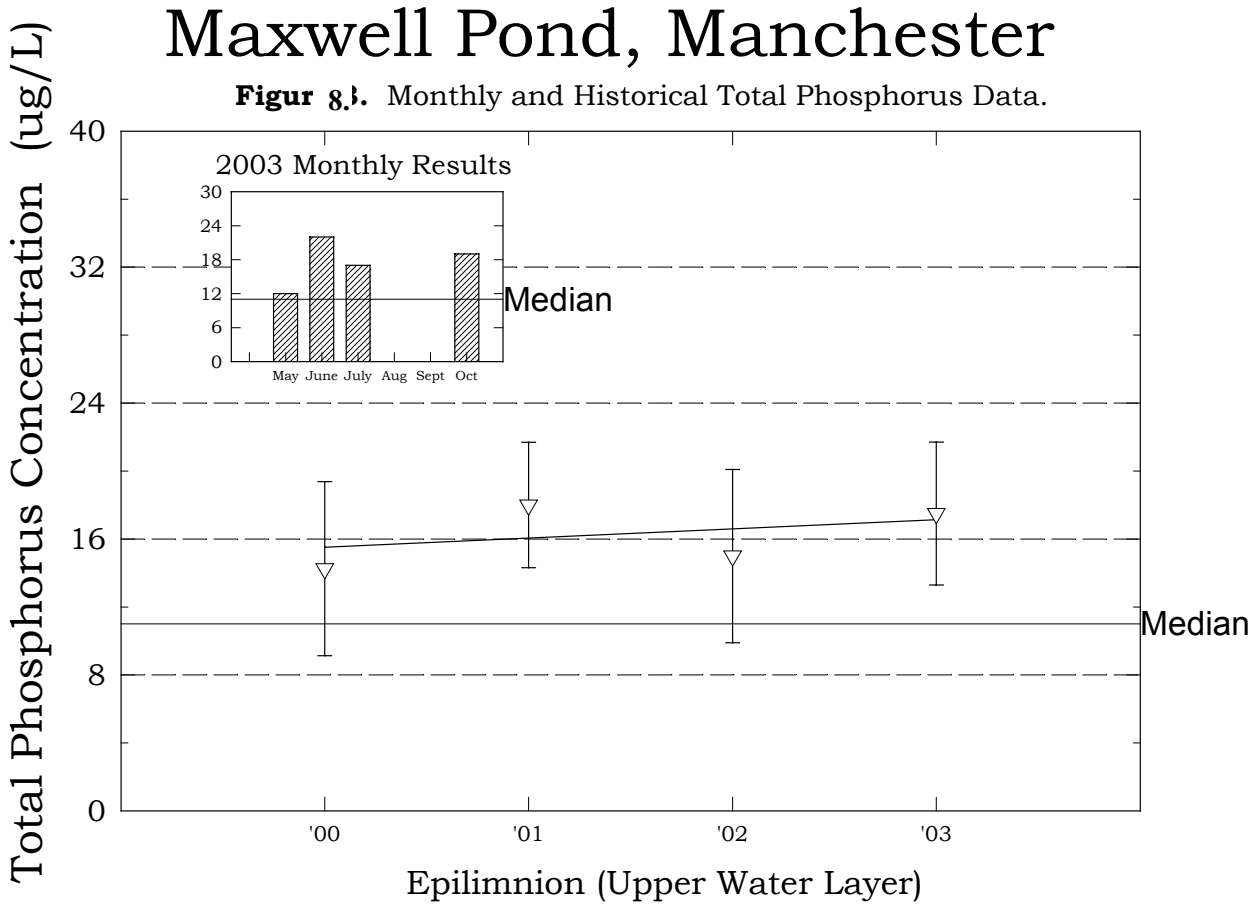
1) All values are epilimnetic.
* NH Dept. of Environmental Services. 1981. Trophic Classification of NH Lakes and Ponds.

Maxwell Pond, Manchester

Figure 7. Monthly and Historical Chlorophyll-a Results







Figur 8.1. Monthly and Historical Total Phosphorus Data.

McQuesten Pond

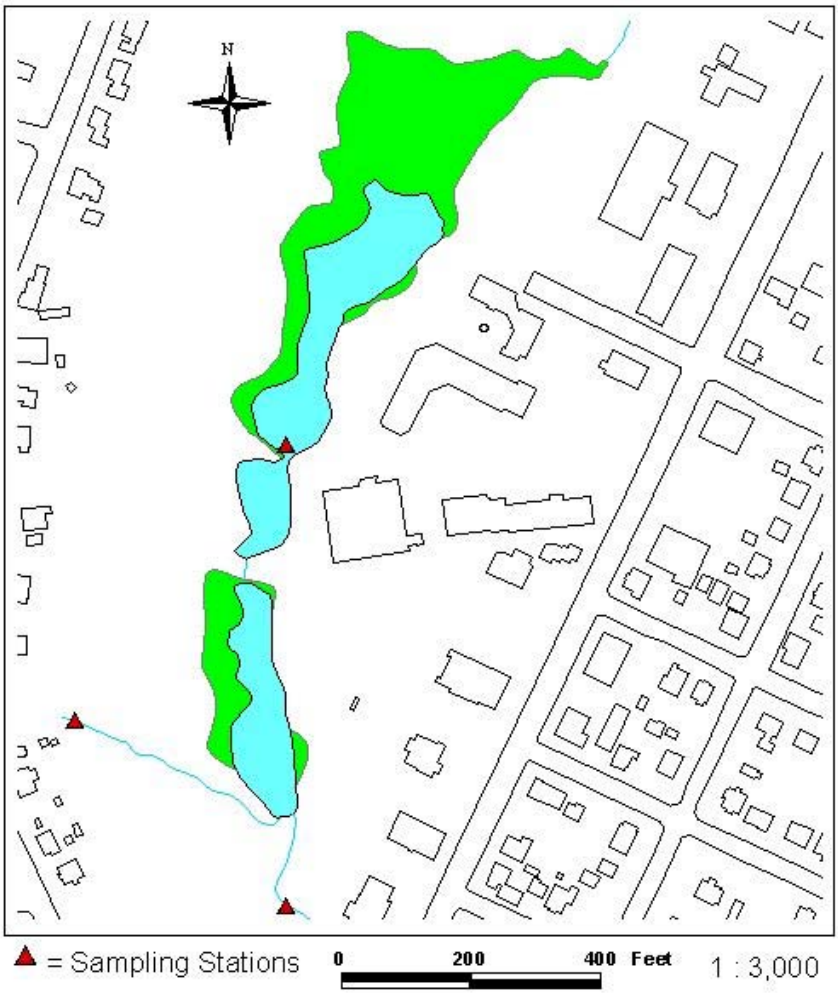
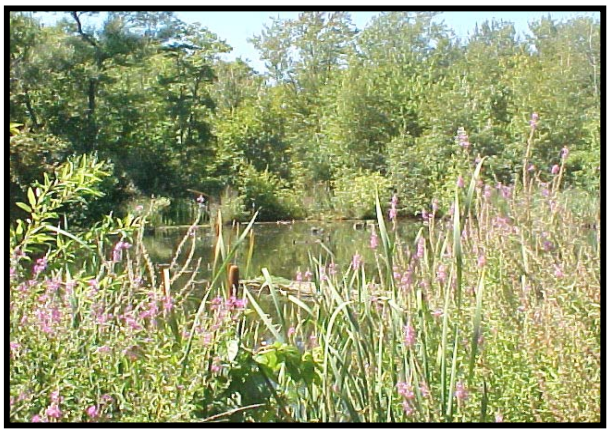


Figure 9 – McQuesten Pond Sampling Stations

Pond Location and Description

McQuesten Pond is located behind the businesses of Second Street and Wolfe Park to the north. It is used for birdwatching and wetlands education. At two feet deep, it is barely able to be classified as a pond at all. The McQuesten wentland area is very rich in life, featuring more than twenty bird species.



McQuesten Pond. Photo by Jen Drociak

Water Quality

McQuesten Pond is in essence, little more than a flooded wetland. It is highly biologically productive partly because of its shallow depth and rich sources of organic debris. Therefore, it is inappropriate to compare this water body to other typical New Hampshire lakes and ponds. The water quality at McQuesten Pond remains consistent after four years of data collection.

Inlet and outlet samples were taken at McQuesten Pond, with a few in-pond samples. McQuesten Pond is less than 18 inches deep in any spot, therefore in-pond sampling was not appropriate here. The flushing rate of the ponded area of the McQuesten wetland complex is high, therefore the inlet and outlet samples are believed to be adequately representative of the larger water body. Sampling was therefore conducted mainly at the inlets and outlets.

Chlorophyll-a

Overall, visual inspection of the historical data trend line (see Figure 10) shows a decreasing in-lake chlorophyll-*a* trend, meaning that the concentration has improved since monitoring began in 2000. However, please keep in mind that this trend is based on an extremely limited data set, and may not be representative of actual conditions.

Conductivity

In-pond conductivity was high, averaging 580.3 uMhos/cm. Outlet conductivity levels were similar at 585.0 uMhos/cm.

The conductivity continues to be very high in this pond. Typically, sources of elevated conductivity are due to human activity. These activities include road and parking lot runoff (which contains road salt during the spring snow melt) and organic debris.

Dissolved Oxygen (DO)

Dissolved oxygen levels in McQuesten Pond indicate a very highly productive system. When DO levels could be discerned, they showed the pond to be supersaturated.

pH and Acid Neutralizing Capacity (ANC)

McQuesten Pond had an average pH of 7.44. Acid neutralizing capacity was relatively high at 39.88 mg/L of CaCO, which agrees with the slightly basic pH characteristics.

The pH this season ranged from 6.58 to 9.32, which means that the water ranged from being slightly acidic to extremely basic (meaning alkaline).

The Acid Neutralizing Capacity (ANC) of the surface waters of the pond continue to remain high, with the mean (39.88 mg/L as $CaCO_3$) being much greater than the state mean (Table). This indicates that the pond is "not vulnerable" to acidic inputs (such as acid precipitation) and has a greater ability than most lakes and ponds in the state to buffer against acidic inputs. While this may seem like a positive condition in the pond, the high ANC is likely due to the degraded conditions of the pond. We suspect that there is a high concentration of pollutants and ions (such as salts) that account for the elevated ANC in the pond.

Phosphorus (TP)

Total phosphorus concentrations in the pond ranged from 0.037 to 0.067 mg/L, averaging 0.054 mg/L. Outlet TP concentrations ranged from .041 to .065 mg/L.

The current year data (see Figure 11) show that the total phosphorus concentration fluctuated throughout the season.

The historical data show that the 2003 mean total phosphorus concentration is much greater than the state median.

Overall, visual inspection of the historical data trend line show an increasing total phosphorus trend, which means that the concentration has worsened since monitoring began in 2000.

Transparency

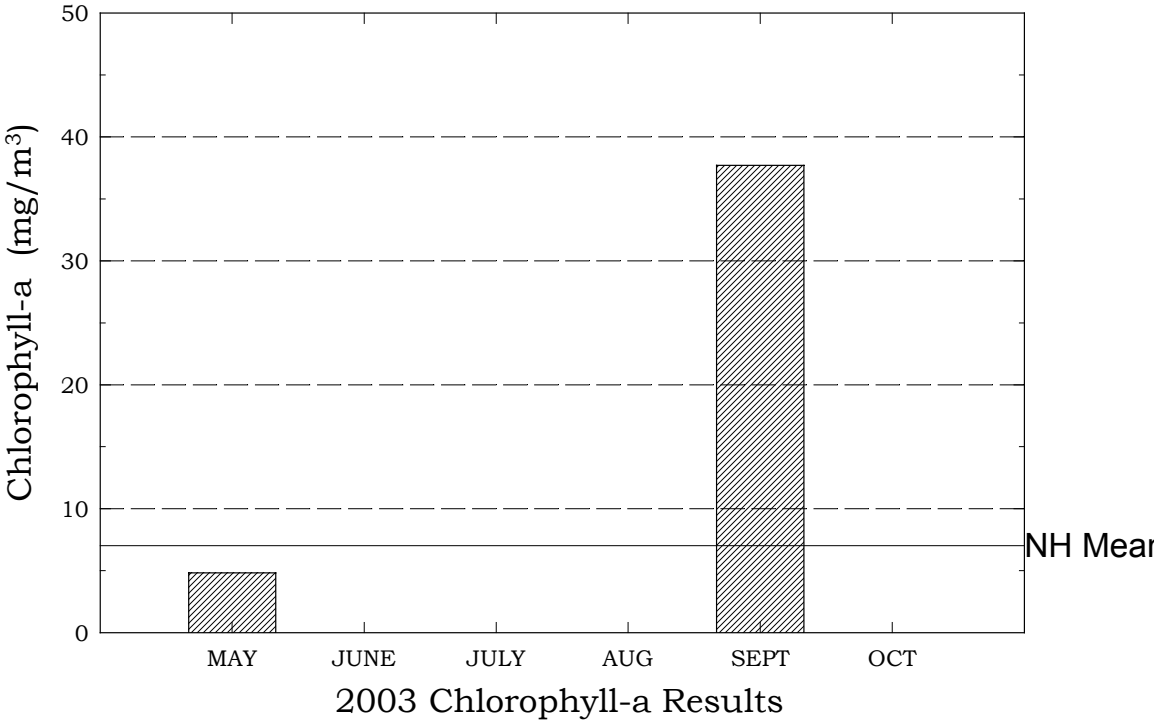
No data are available for transparency, as the pond is too shallow for this test. The bottom of the pond is visible.

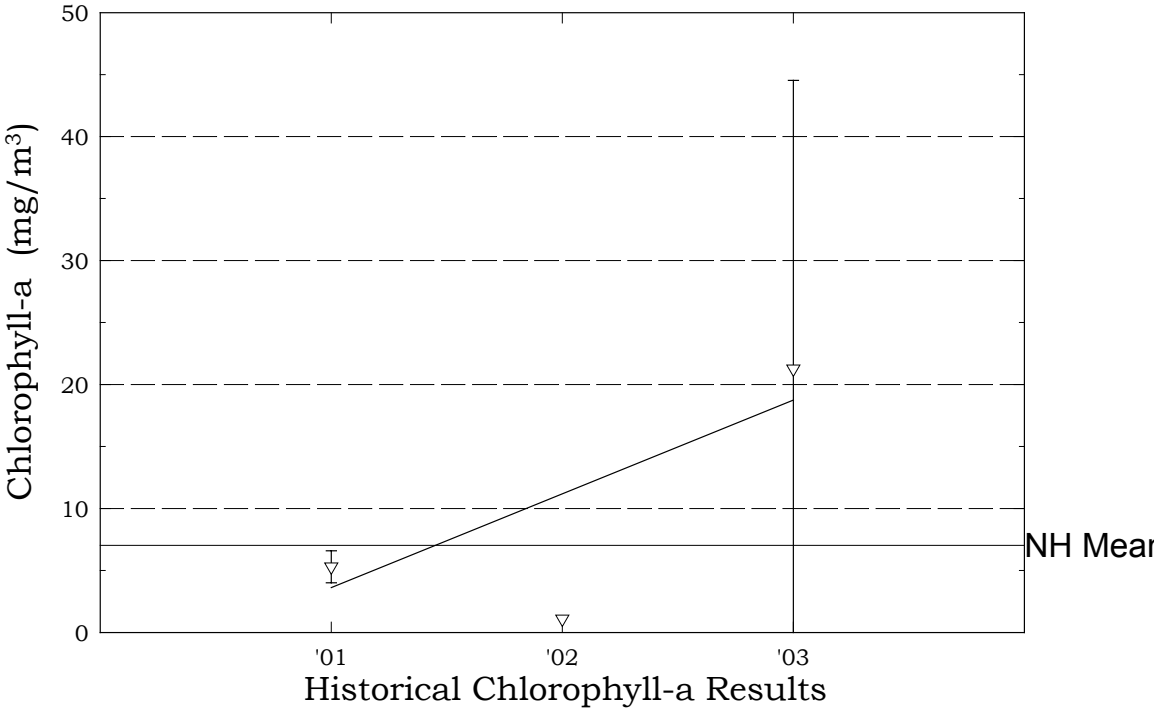
Turbidity

Outlet turbidity ranged from 2.03 to 6.88 NTU and averaged 3.95 (NTU).

McQuesten Pond, Manchester

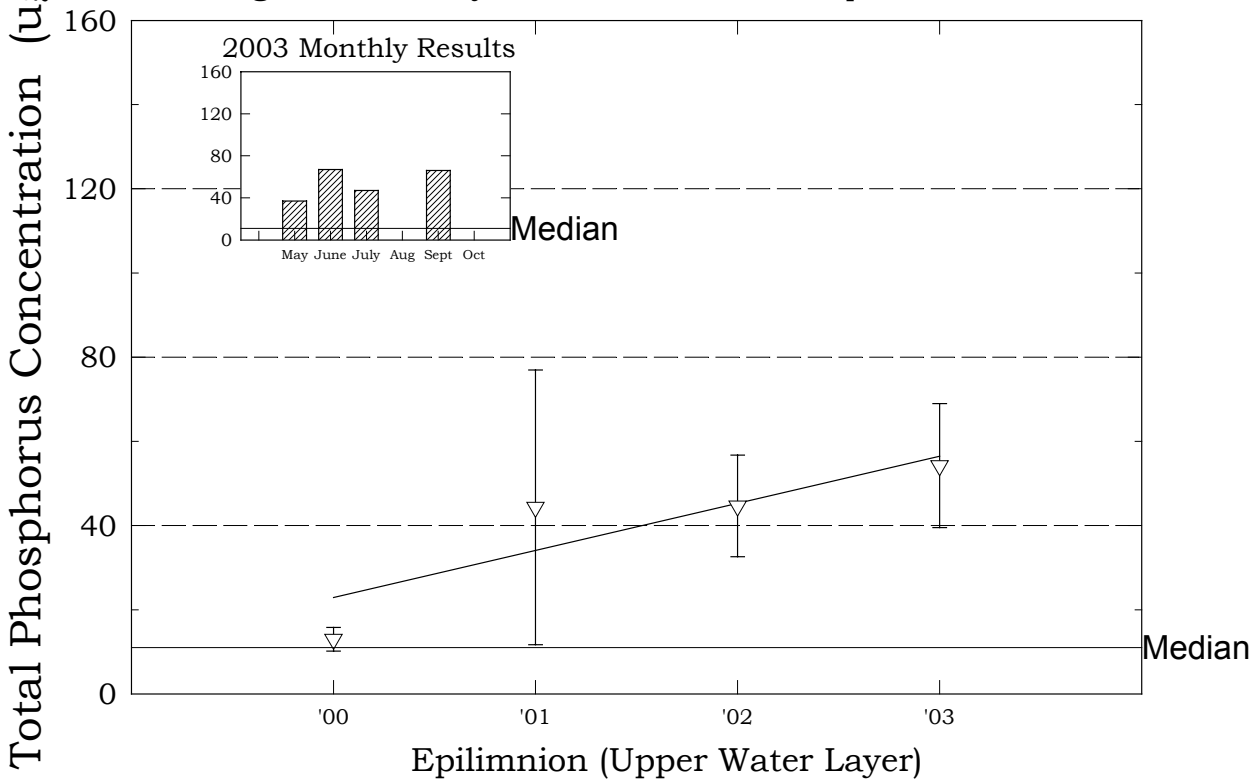
Figure 10. Monthly and Historical Chlorophyll-a Results





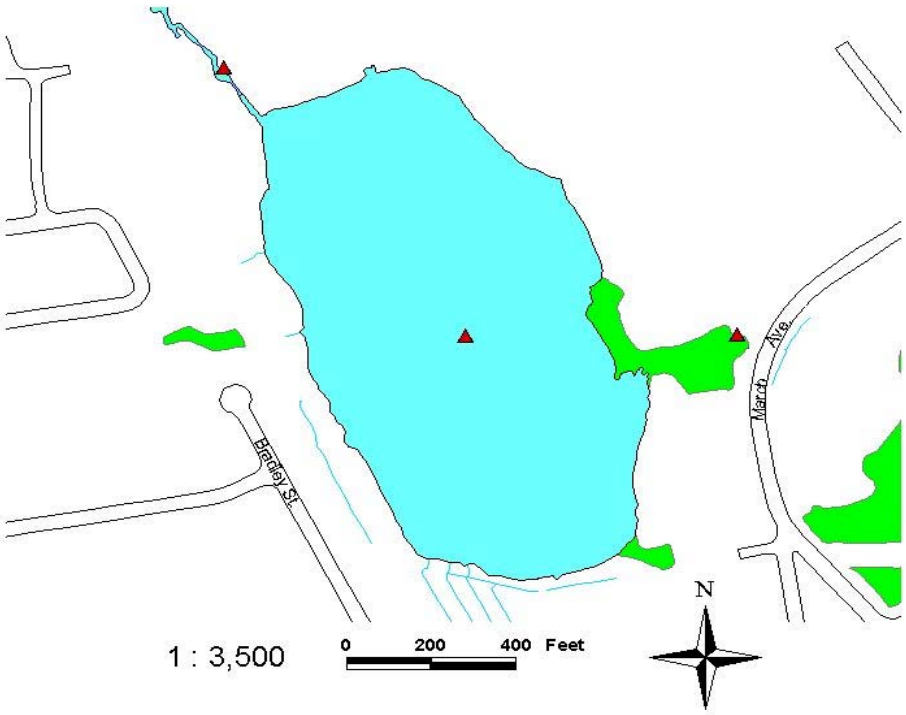
McQuesten Pond, Manchester

Figure 11. Monthly and Historical Total Phosphorus Data.



Nutts Pond

Figure 12 – Nutts Pond Sampling Stations



Pond Location and Description

Nutts Pond, located behind the businesses of South Willow Street, is used for fishing and boating. Baseball and soccer fields abut the pond to the north.

Water Quality

Nutts Pond receives large amounts of untreated urban runoff. Its watershed consists of strip malls, industrial lots, streets, and residential neighborhoods. Runoff to Nutts Pond receives little to no treatment. Since heavy development began in the area approximately 30 years ago, sediment and pollution has been accumulating in stormwater created deltas at four points in the pond (N, E, S, W). The pond has high levels of heavy metals in the water column and is heavily influenced by ground water. At this point it remains unknown if the metals found in the water column (particularly iron) are derived from groundwater or other possible sources (such as accumulated debris in the pond or street runoff). Wet weather sampling of Nutts Pond inlets in 2002 did not show unusually high iron concentrations. Nutts Pond has shown steady decline in water quality over the last twenty years, as the table indicates.

Nutts Pond. Photo by Jen Drociak

Chlorophyll-*a*

Composite chlorophyll-*a* concentrations for the upper metalimnion and epilimnion ranged from 2.35 to 55.72 mg/m^3 and averaged 17.13 mg/m^3. This is a high concentration considering the "typical" value for a NH lake is 3.9 mg/m^3. Chlorophyll-*a* concentration varied greatly throughout the season. Compared to 2001 an 2002, the 2003 mean has worsened, but is still better than the mean chlorophyll-*a* concentration in 2000. Keep in mind that this is a limited data set.

The current year data (see Figure 13) show that 2003 chlorophyll-*a* levels were variable, but never dropped below the state mean. Overall, visual inspection of the historical data trend also shows a variable but consistently high chlorophyll-*a* mean.

After 10 consecutive years of sample collection from the lake/pond, we could conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began. For data less than 10 years, it is difficult to definitively say whether a trend exists.

Chloride

This year was the second year that the chloride concentration was measured at the deep spot of the pond. In New Hampshire, the median chloride concentration for lakes/ponds is 5 mg/l. The one-time sample measured in Nutts Pond this season found 561mg/l in the hypolimnion. This is similar to the levels found in 2002.

Conductivity

Conductivity levels were very high, especially in the hypolimnion, where readings ranged from 1894 to 2080 uMhos/cm, and averaged 2017.7 uMhos/cm. This is related to metals contamination in the water column. Epilimnion conductivity ranged from 510 to 1210 uMhos/cm, and averaged 786.0 uMhos/cm. These numbers represent the highest average conductivity readings ever recorded at Nutts Pond.

Dissolved Oxygen (DO)

Nutts Pond was stratified before sampling began in April of 2003. Each sampling session identified a clearly defined epilimnion, metalimnion, and hypolimnion. Dissolved oxygen was almost nonexistent in the lowest depths of Nutts Pond, regularly measuring as low as 2.0% DO saturation. These anoxic (very low oxygen) conditions are causing internal phosphorus loading in Nutts Pond. In other words, the low oxygen is causing organisms in the pond to release phosphorus from the sediments.

The dissolved oxygen concentration was greater than 100% saturation at 0.1, 1.0, and 2.0 meters at the deep spot on the April, June and July sampling events. High amounts of oxygen in the upper layers of the water column can be the result of two different conditions.

Layers of algae can raise the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth of the photic zone (depth to which sunlight can penetrate into the water column) was approximately 1.1 to 2.3 meters on these sampling dates (as shown by the Secchi-disk transparency), and that the metalimnion (layer of rapid decrease in water temperature and increase in density – a place where algae are often found) was located between approximately 2 and 5 meters, we suspect that an abundance of algae may have contributed to the oxygen super saturation.

Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Considering that windy conditions were indicated on these dates, wave action may have also contributed to the oxygen super saturation.

The dissolved oxygen concentration was very low in the metalimnion and hypolimnion at the deep spot of the lake/pond this season. As stratified lakes/ponds age, oxygen becomes depleted in the hypolimnion (the lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological

breakdown of organic matter both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion (as it was this season and in past seasons), the phosphorus that is normally bound up in the sediment may be re-released into the water column.

During this season, and many past sampling seasons the lake/pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion than in the epilimnion These data suggest that the process of internal total phosphorus loading is occurring in the lake/pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion (as it was this season and in many past seasons), the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Depleted oxygen concentration in the hypolimnion of thermally stratified lakes/ponds typically occurs as the summer progresses.

pH and Acid Neutralizing Capacity (ANC)

Nutts Pond pH values ranged from 6.44 to 6.88 and averaged 6.68. This is within the range considered ideal for freshwater ecosystems. The ANC values varied very little, ranging from 13.8 to 20.4 mg of CaCO/L and averaging 16.97 mg/L.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

Phosphorus (TP)

As expected, the concentrations of phosphorus were the highest in the hypolimnion ranging from 0.038 to 0.177 mg/L and averaging 0.109 mg/L. These are by far the highest TP concentrations of any Manchester pond. This is likely due to runoff from surrounding commercial and recreational areas and internal loading. Epilimnion TP values ranged from 0.018 to 0.046 mg/L and averaged 0.03 mg/L. These are similar to TP levels found in 2002. Hypolimnion TP levels seem to have lowered, but epilimnion TP levels have risen slightly

The historical data (see Figure 14) for the epilimnion show that the 2003 total phosphorus mean is much greater than the state median. Overall, visual inspection of the historical data trend line for the epilimnion shows an increasing total phosphorus trend, which means that the concentration has worsened in the epilimnion since monitoring began.

The historical data for the hypolimnion show that the 2003 total phosphorus mean is greater than the state median. Overall, the historical data trend line for the hypolimnion shows an increasing total phosphorus trend, which means that the concentration has worsened in the hypolimnion since monitoring began.

Transparency

As in past years, Secchi disk transparency and chlorophyll-*a* content appeared to be related at Nutts Pond. In general, when chlorophyll-*a* was high, transparency was low. Transparency ranged from 1.1 to 3.4 meters, and averaged 2.3 meters.

The historical data (see Figure 15) show that the 2003 mean transparency is less than that of the state mean.

Overall, visual inspection of the historical data trend shows a relatively stable trend for in-lake transparency, meaning that the transparency has remained approximately the same since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into the lake/pond and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond.

Turbidity

Turbidity was high in Nutts Pond, especially in the hypolimnion where values ranged from 24.7 to 105 (NTU) and averaged 60.1 (NTU). Epilimnion turbidity values were much lower, averaging 2.8 (NTU). The high turbidity in the hypolimnion may be due to metals contamination. Turbidity readings in 2003 were similar to those of previous years.

The turbidity of the hypolimnion sample was elevated on all sampling events this year, similarly to previous sampling seasons. This suggests that the lake/pond bottom *may* have been disturbed by the anchor or by the Kemmerer Bottle while sampling. When the lake/pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. The hypolimnion is also known to have high metals concentrations, which can be seen visually.

Table 6[1]
Comparison of Nutts Pond – 1981*, 1995**, 2000 – 2003

Parameter	1981	1995	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
PH	7.1	8.9	6.77	6.79	6.82	6.83	6.77	6.77	6.68	6.68
Alkalinity (mg/l)	12.0	15.8	13.9	14.1	17.3	17.0	15.4	15.4	17.0	17.5
Total Phosphorus (mg/l)	0.025	0.025	0.015	0.013	0.023	0.019	0.024	0.024	0.03	0.029
Conductivity (uMhos/cm)	194	567	488	454	714.2	630.5	580.4	546.0	786	790
Secchi Disk (m)	2.5	2.5	3.1	3.3	2.4	2.6	2.9	2.9	2.3	2.3
Chlorophyll-*a* (mg/m3)			27.42	21.12	14.01	10.94	10.81	7.73	17.13	11.56

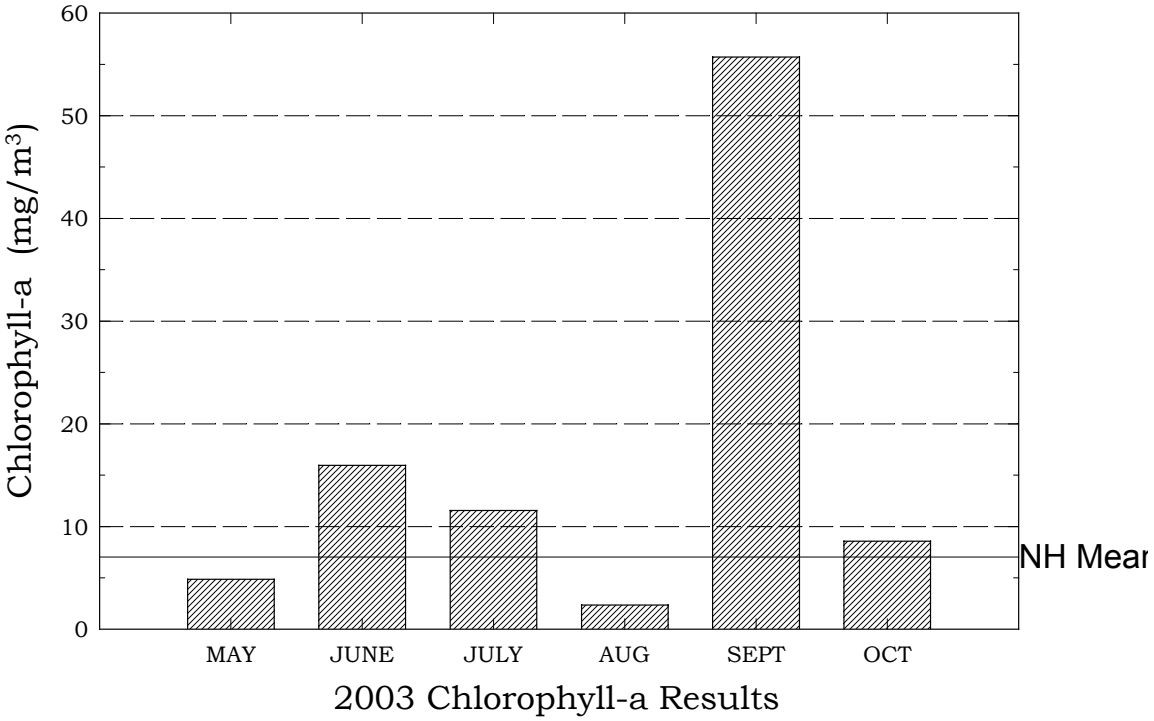
1) All values are epilimnetic.

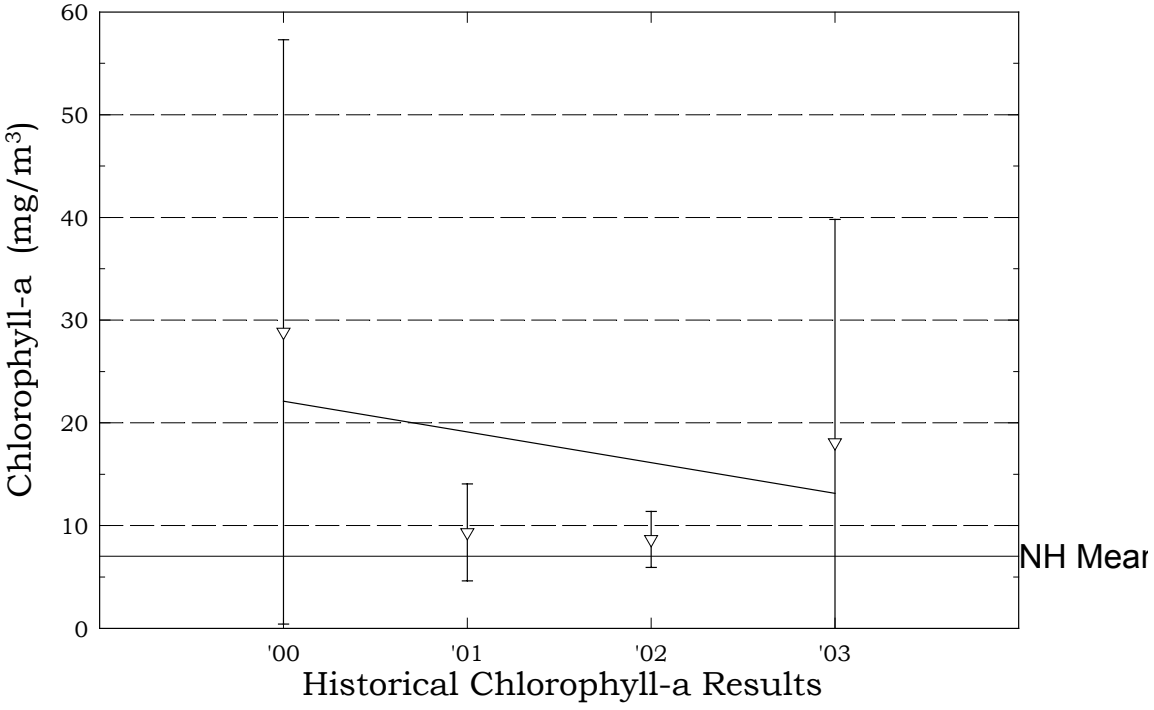
* NH Dept. of Environmental Services. 1981. Trophic Classification of NH Lakes and Ponds.

** NH Dept. of Environmental Services. 1996. Lake Trophic Data.

Nutts Pond, Manchester

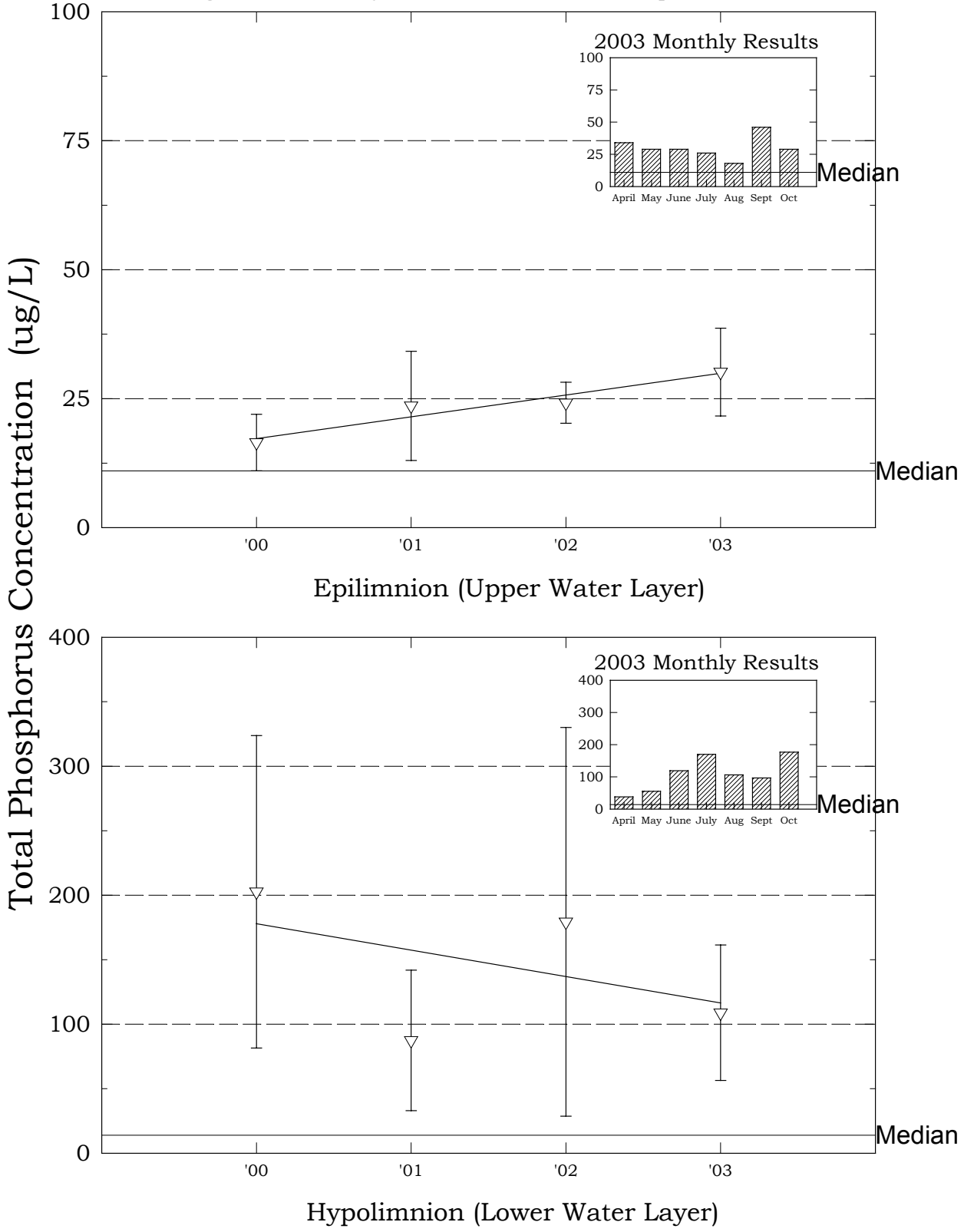
Figure 13. Monthly and Historical Chlorophyll-a Results





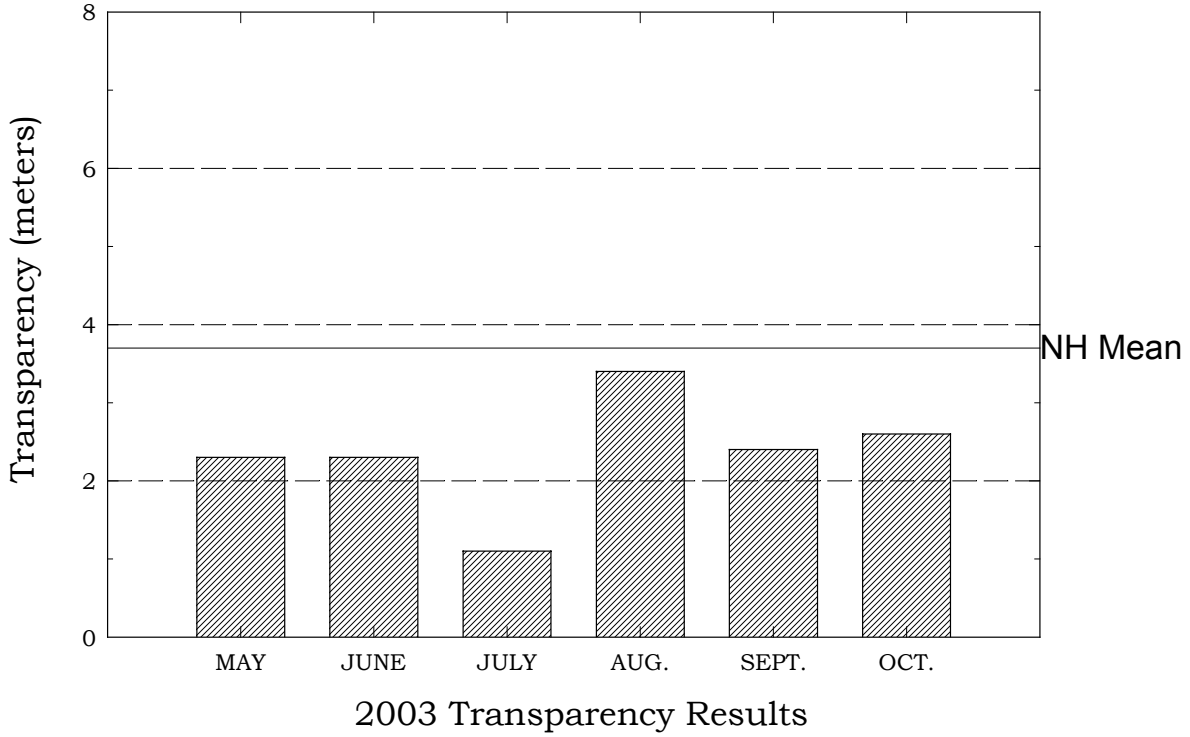
Nutts Pond, Manchester

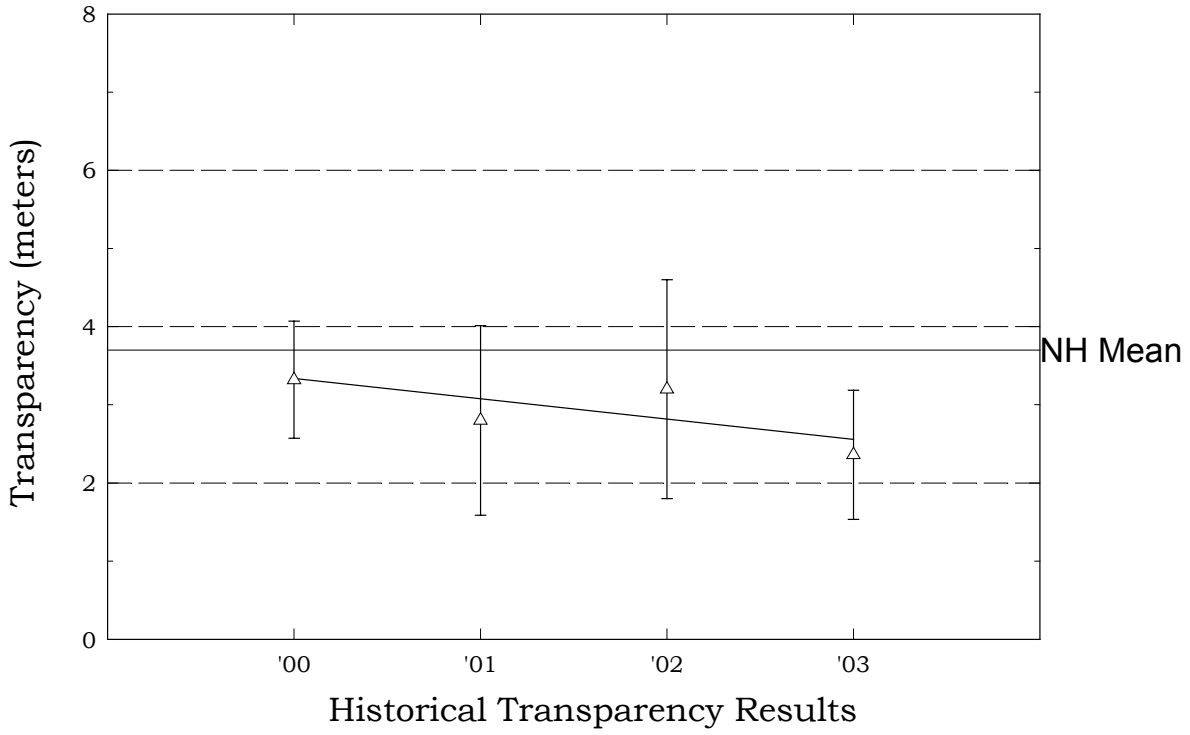
Figure 14. Monthly and Historical Total Phosphorus Data.



Nutts Pond, Manchester

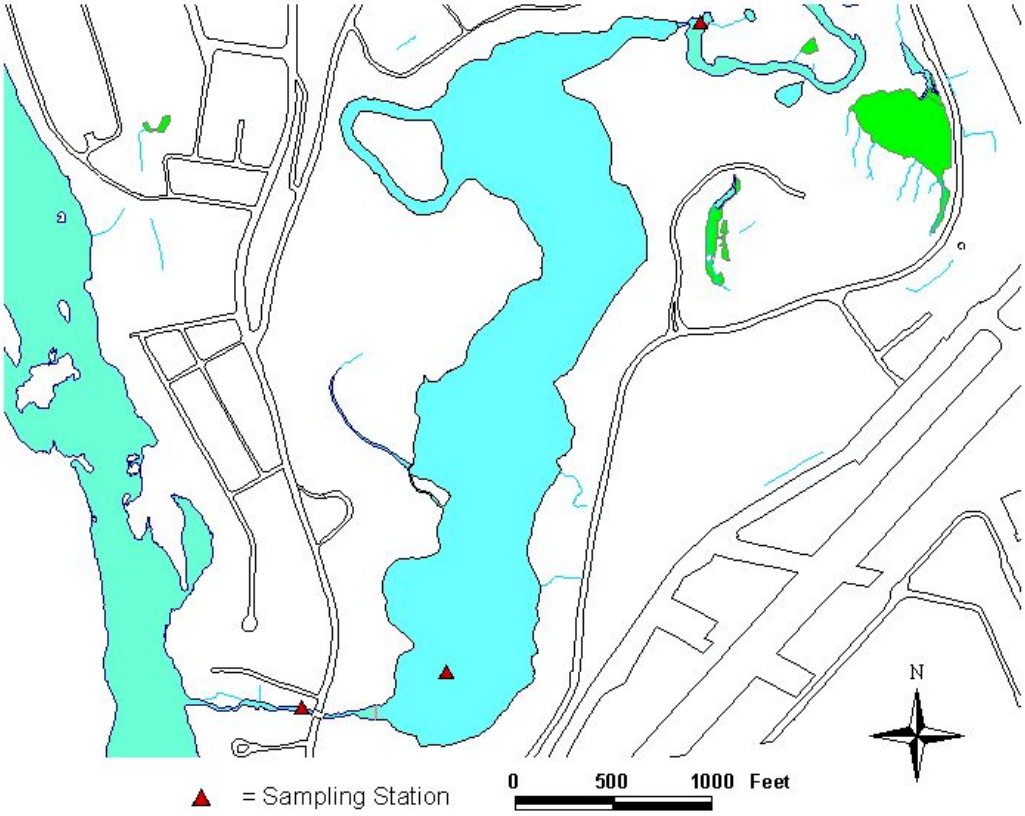
Figure 15. Monthly and Historical Transparency Results





Pine Island Pond

Figure 16 – Pine Island Pond Sampling Stations



Pond Location and Description

Pine Island Pond is located east of Brown Avenue and abuts the Manchester Airport. It's outlet (Cohas Brook) flows under Brown Ave to the Merrimack River. Pine Island Pond is used for boating, fishing, and occasional swimming.

Pine Island Pond. Photo by Art Grindle

Water Quality

More than just immediate water quality data is required to understand the condition of Pine Island Pond. This waterbody in particular has the potential to change very quickly with changes in the watershed. Close and careful monitoring is essential to the future health of Pine Island Pond.

Pine Island Pond water quality is still relatively good. It is still used for swimming, fishing and boating. Twenty years of increasing watershed development have impacted the pond, however. Pine Island Pond has seen a slow but steady decline in water quality over the past twenty years, but over the past three years has experienced fluctuations in water quality conditions.

Chlorophyll-*a*

Composite chlorophyll-*a* concentrations ranged from 0.14 to 3.44 mg/m^3 with an average of 2.21 mg/m^3. This is a substantial decrease from all previous years.

The current year data (see Figure 17) show that the chlorophyll-*a* concentration increased gradually from April through July, then decreased.

The historical data show that the 2003 chlorophyll-a mean is slightly lower than the state mean. Overall, visual inspection of the historical data trend shows a decreasing in-lake chlorophyll-a trend, meaning that the concentration has improved since monitoring began. We hope this trend continues! Please note that this trend is based on only three years of data.

After 10 consecutive years of sample collection for the pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

Conductivity

Conductivity values were also relatively uniform throughout the water column. The epilimnion averaged 338.5 uMhos/cm. The hypolimnion averaged 306.3 uMhos/cm. All conductivity values are high when compared to a "natural, undisturbed lake", but have not changed drastically since 1981.

Dissolved Oxygen (DO)

Dissolved oxygen concentrations were fairly stable in 2003 with steady decline as the season progressed. The lowest DO readings were recorded in July.

The dissolved oxygen concentration was low in the hypolimnion at the deep spot of the pond in July and August. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the pond where the water meets the sediment.

During this season, and the past sampling seasons the pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion than in the epilimnion. These data suggest that the process of internal total phosphorus loading is occurring in the pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion (as it was this season and in many past seasons), the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Depleted oxygen concentration in the hypolimnion of thermally stratified lakes/ponds typically occurs as the summer progresses.

pH and Acid Neutralizing Capacity (ANC)

Pine Island Pond pH values ranged from 6.50 to 6.8 and averaged 6.65. This is similar to pH values recorded in previous years. ANC values ranged from 6.3 to 20.0, and averaged 14.55 mg of CaCO/L. These readings indicate that Pine Island Pond has substantial buffering capacity. ANC, like pH, seems to remain steady year after year.

Phosphorus (TP)

As discussed above with low dissolved oxygen, an internal source of phosphorus in the pond may be present. Therefore, it is even more important that watershed residents act proactively to minimize external phosphorus loading from the watershed. For instance, picking up after pets, minimizing fertilizers on lawns, etc.

Pine Island Pond total phosphorus readings were relatively uniform throughout the water column, with the epilimnion averaging .029 mg/L and hypolimnion averaging .031 mg/L. These values are higher than those recorded in all previous years.

The historical data (see Figure 18) for the epilimnion show that the 2003 total phosphorus mean is greater than the state median. Overall, visual inspection of the historical data trend for the epilimnion shows a variable total phosphorus trend, which means that the concentration has fluctuated in the epilimnion since monitoring began.

The historical data for the hypolimnion show that the 2003 total phosphorus mean is also greater than the state median. Overall, visual inspection of the historical data trend for the hypolimnion shows a relatively stable total phosphorus trend, which means that the concentration has remained approximately the same in the hypolimnion since monitoring began.

As discussed previously, these trends are based on a limited data set.

Transparency

Secchi disk transparency dropped steadily as chlorophyll-*a* concentration increased, though there was some variability between these two parameters. Transparency ranged from 1.6 to 2.3 meters and averaged 1.9 meters. Pine Island Pond has a natural tea color caused by the presence of tannins (plant pigments). This condition limits water transparency. Average Secchi disk transparency has remained consistent at 1.9 meters for the past 4 years.

The historical data (see Figure 19) show that the 2003 mean transparency is less than the state mean. Overall, visual inspection of the historical data trend shows a steady trend for in-lake transparency, meaning that the transparency has remained similar since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into the pond and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond.

Turbidity

Turbidity ranged from 2.42 to 16.3 (NTU) in the hypolimnion and averaged 7.91 (NTU). Epilimnion turbidity ranged from 1.64 to 7.98 (NTU). The peak turbidity was recorded in August, coinciding with high TP readings and low transparency. This pattern also occurred in 2002 and 2001 at the end of the summer season.

Pine Island Pond experiences high turbidity levels as a natural condition of its tannic waters.

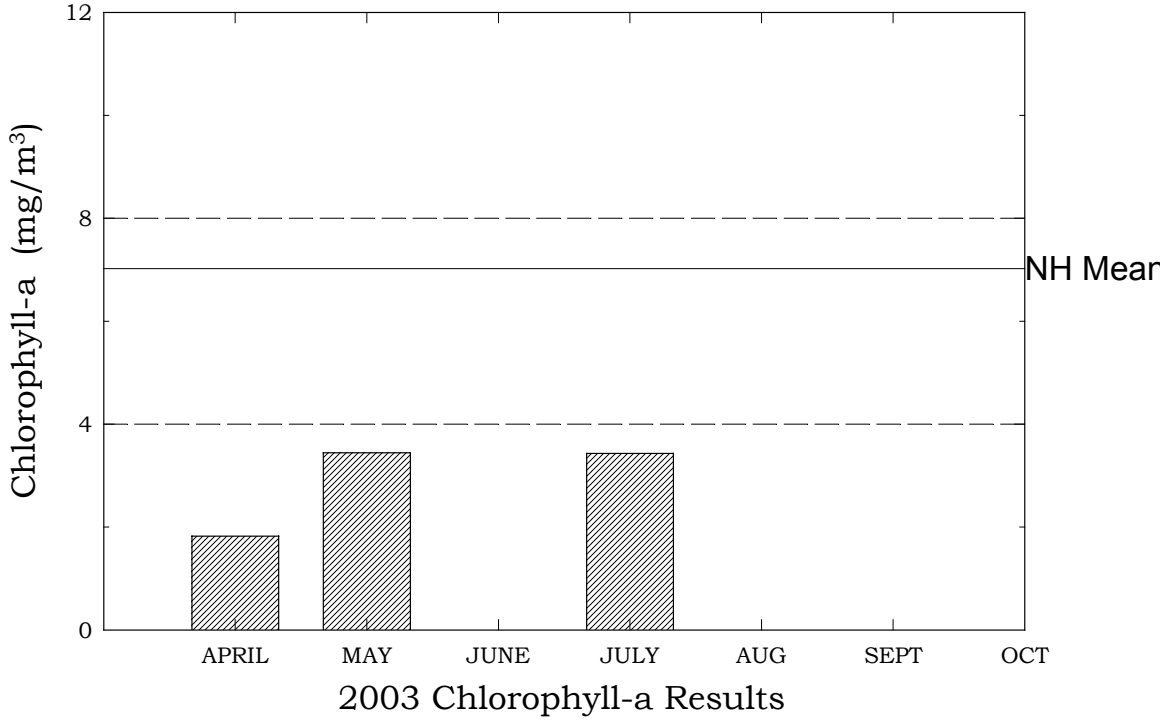
Table 7[1]
Comparison of Pine Island Pond – 1980*, 1997, 2000 – 2003**

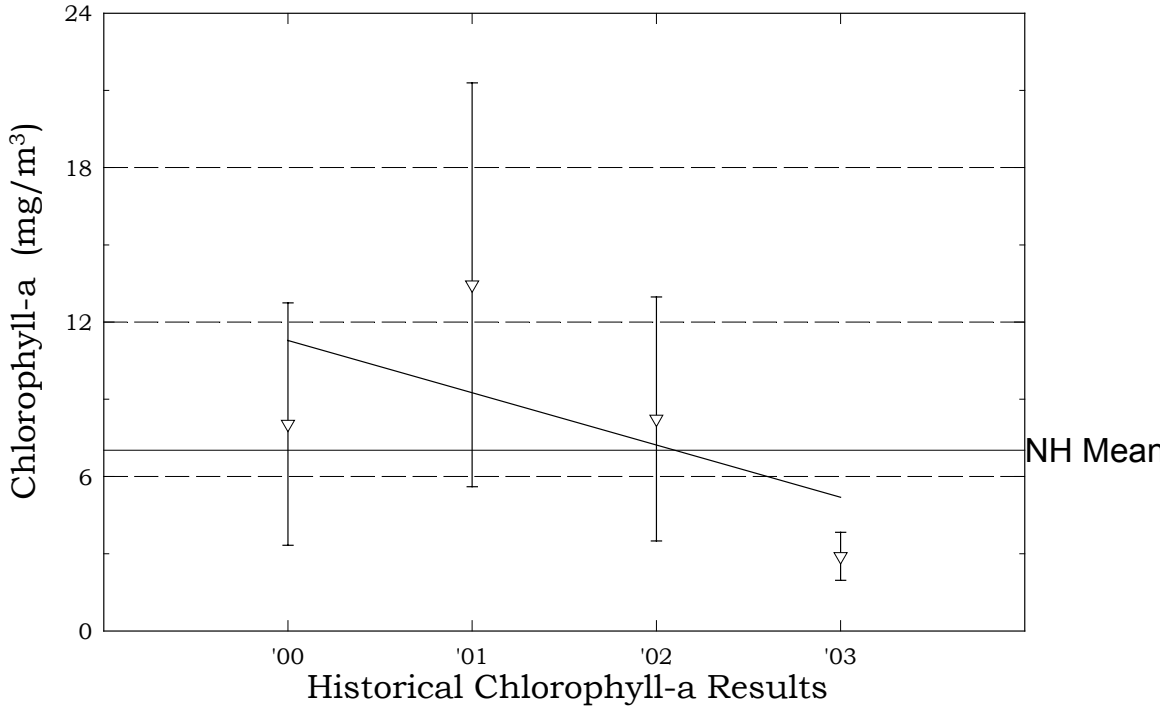
Parameter	8/5/80	7/24/97	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
pH	7.1	7.2	6.97	7.07	7.00	7.04	6.86	6.93	6.65	6.64
Alkalinity (mg/l)	15.2	20.6	17.1	19.5	20.1	21.0	21.2	24.5	14.6	16.0
Total Phosphorus (mg/l)	0.015	0.018	0.024	0.024	0.016	0.017	0.023	0.026	0.029	0.033
Conductivity (uMhos/cm)	142.8	290.4	287.1	308.0	383.3	412.5	316.1	357.5	338.5	364.5
Secchi Disk (m)	2.0	1.4	1.9	1.9	1.9	1.7	1.9	2.0	1.9	1.8
Chlorophyll-*a* (mg/m3)			8.0	8.6	13.2	11.4	8.23	7.38	2.21	2.63

1) All values are epilimnetic. * NH Dept. of Environmental Services. 1980. Trophic Classification of NH Lakes and Pond.
** NH Dept. of Environmental Services. 1998. Lake Trophic Data.

Pine Island Pond, Manchester

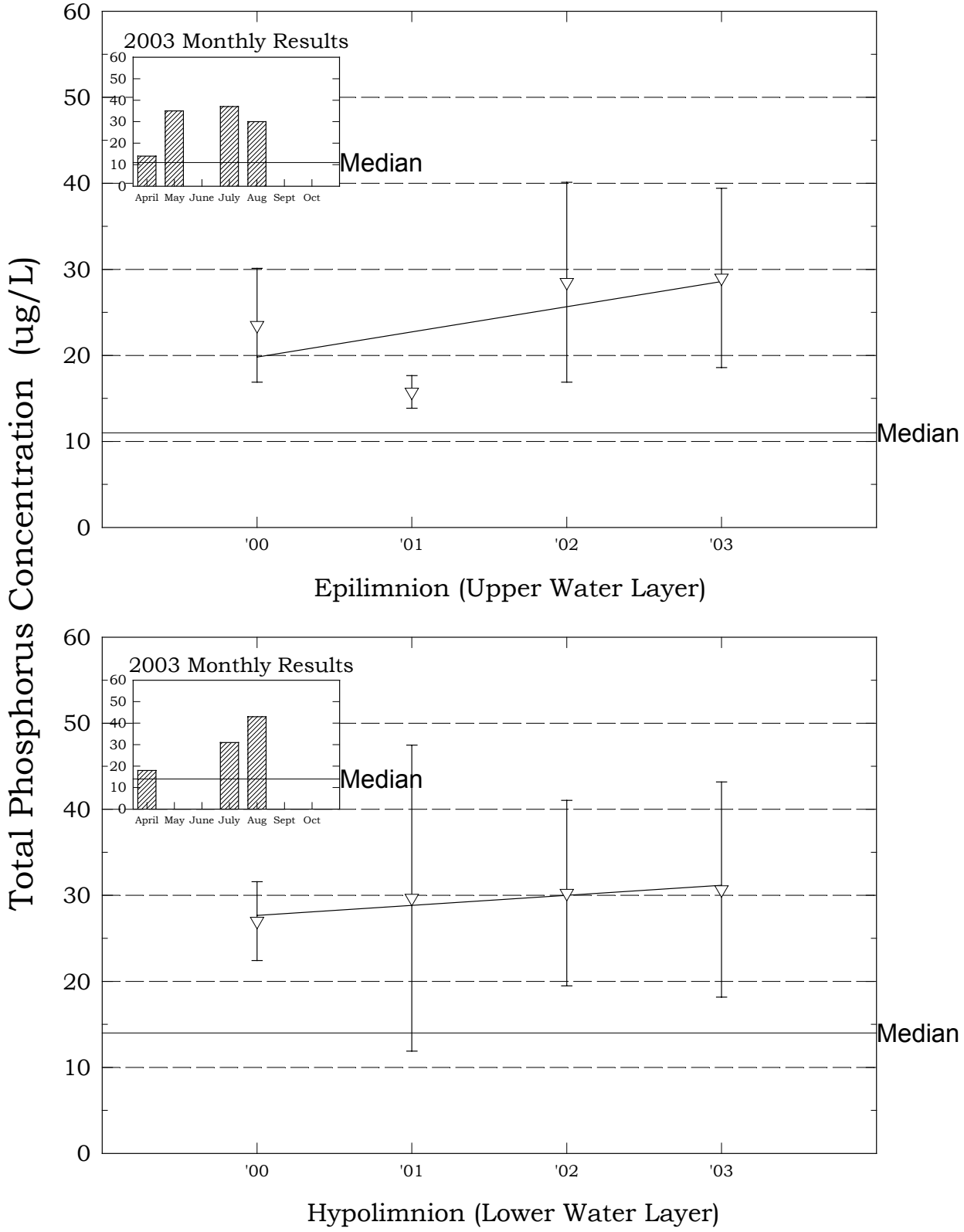
Figure 17. Monthly and Historical Chlorophyll-a Results





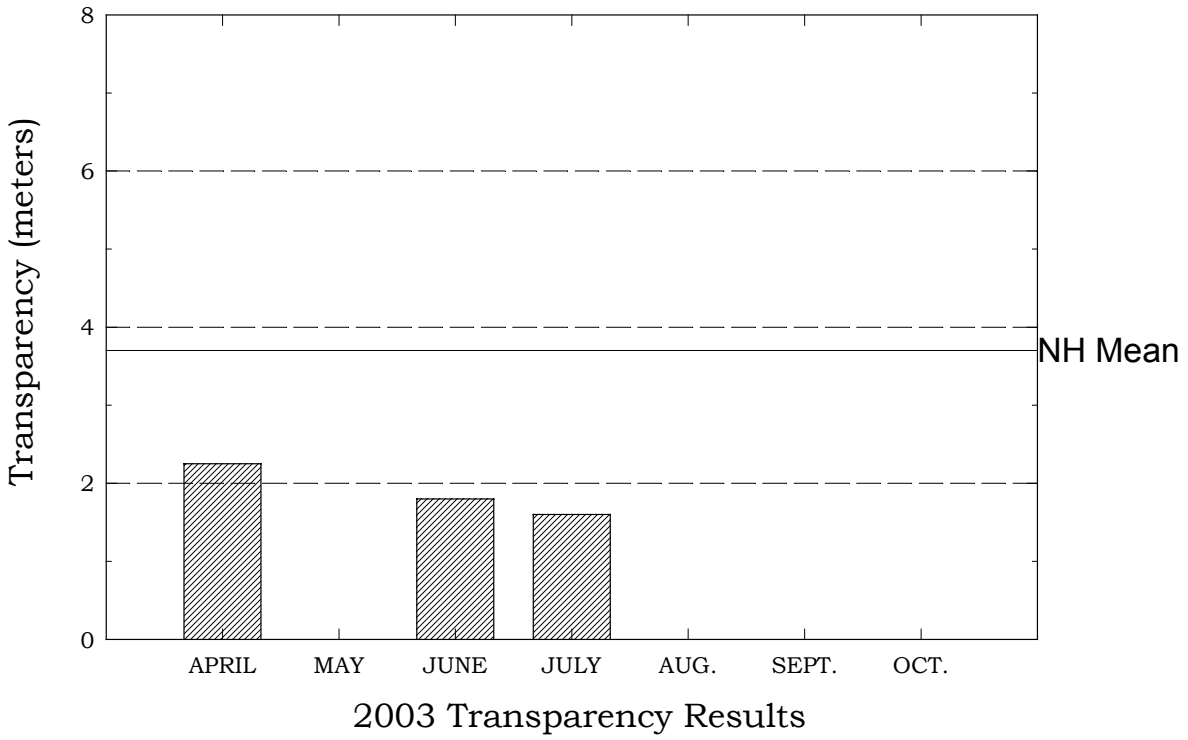
Pine Island Pond, Manchester

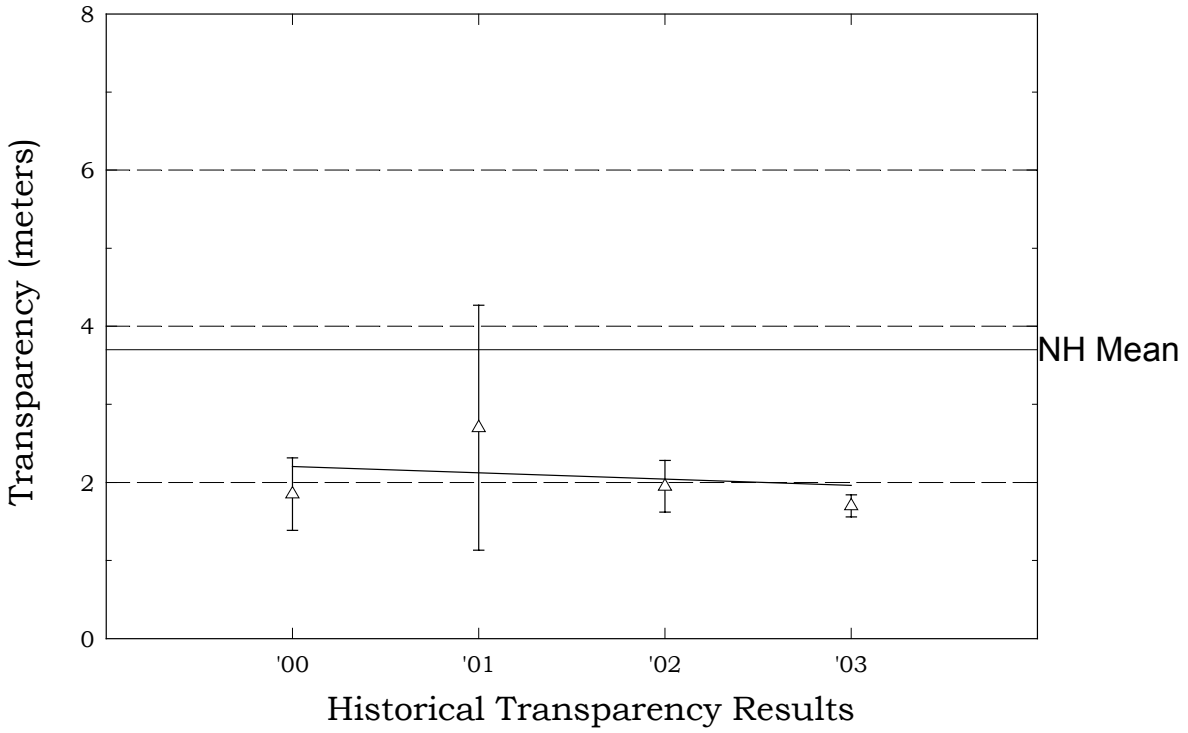
Figure 18. Monthly and Historical Total Phosphorus Data.



Pine Island Pond, Manchester

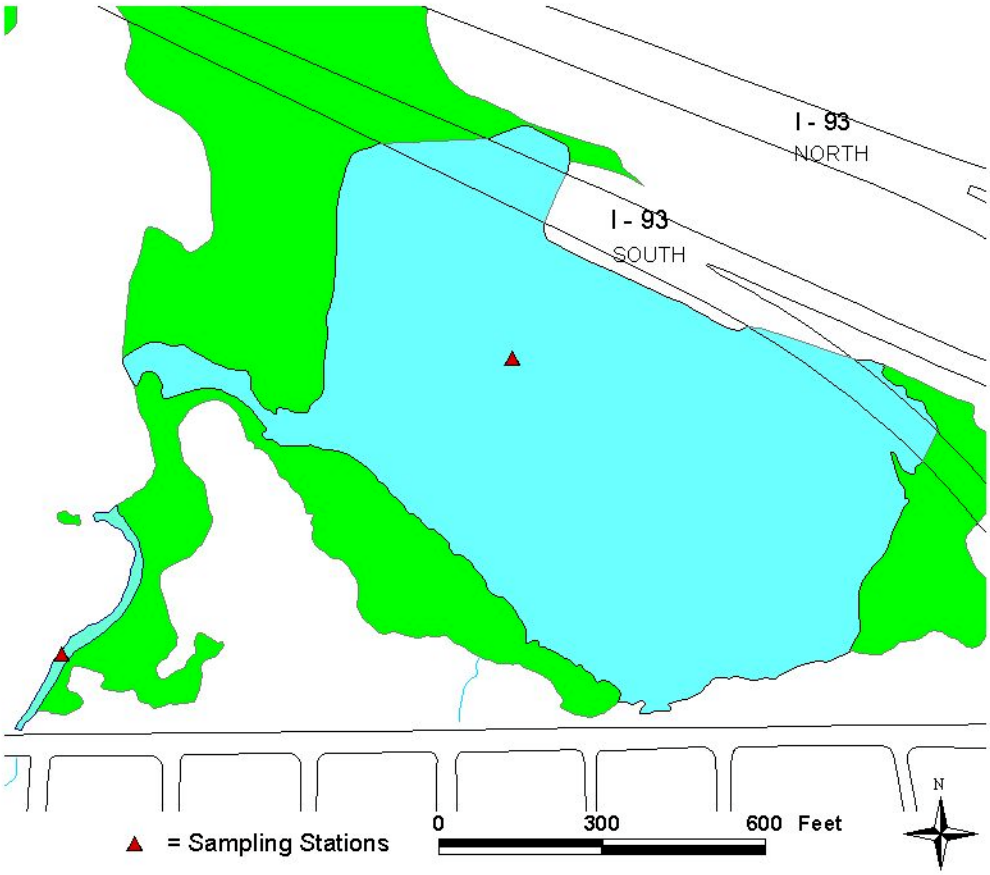
Figure 19. Monthly and Historical Transparency Results





Stevens Pond

Figure 20 – Stevens Pond Sampling Stations



Pond Location and Description

Stevens Pond is located off Bridge Street Extension, under I-93 near the Route 101 interchange. It is commonly used for fishing, boating, and ice skating.

Water Quality

For more than 30 years, Stevens Pond has been impacted by untreated highway runoff from Interstate 93. De-icing activities and automotive byproducts have led to the serious degradation of a popular fishing and swimming spot in Manchester. Increasing residential development in the watershed is also an issue of concern.

Stevens Pond. Photo by Cyndy Carlson

Stevens Pond has been severely impacted by development. Eutrophication is being accelerated by highway runoff. Chloride and sodium levels are among the highest ever recorded in a freshwater body in New Hampshire. Significant decline cannot be seen over the past twenty years, with the exception of conductivity levels. Stevens Pond accelerated eutrophication apparently began before documentation of conditions in 1981.

Chlorophyll-*a*

Composite chlorophyll-*a* concentrations for the upper metalimnion and epilimnion ranged from 1.34 to 7.83 and averaged 4.28 mg/m^3. This is the lowest average chlorophyll-*a* concentration ever recorded at Stevens Pond (since 2000).

The historical data (see Figure 21) show that the 2003 chlorophyll-*a* mean is lower than the state mean for 2003. Overall, chlorophyll-*a* concentration fluctuated little over the season.

Overall, visual inspection of the historical data trend shows a varied in-lake chlorophyll-*a* trend, meaning that the concentration has fluctuated year to year since monitoring began in 2000. However, please keep in mind that this trend is based on a limited amount of data.

Chloride

This year was the second year that the chloride concentration was measured at the deep spot of the lake. In New Hampshire, the median chloride concentration for lakes/ponds is 5 mg/L. The chloride in pond ranged from 460 mg/L in the epilimnion to 628 mg/L in the hypolimnion. The increase of chloride concentration from the epilimnion to the hypolimnion may indicate the presence of a chemocline.

Conductivity

Conductivity levels remained relatively constant throughout the season and throughout the water column with peak conductivity occurring in April (same as 2002). Epilimnion conductivity ranged from 1042 to 1564 and averaged 1257.8 uMhos/cm. Metalimnion conductivity ranged from 1100 to 1281 and averaged 1196.7 uMhos/cm. Hypolimnion conductivity ranged from 1177 to 2130 and averaged 1606.0 uMhos/cm. These numbers are higher than those recorded in 2002. In general, levels were highest at the beginning of the season and gradually decreased through the season. These are very high readings, indicative of a very degraded water body.

Typically, sources of elevated conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake), and stormwater runoff from urbanized areas (which typically contains road salt during the spring snow melt). In addition, natural sources, such as iron deposits in bedrock, can influence conductivity. Due to the history and present status of this highly urbanized watershed, and proximity of I-93, the high conductivity levels in the pond are probably in part due to runoff from the overpass.

Dissolved Oxygen (DO)

Thermal stratification was already apparent at Stevens Pond when monitoring began in early April. DO was highly variable throughout the water column in 2003. Super-saturation of dissolved oxygen was observed in the epilimnion in April and May and also in the Metalimnion in May and June. Super-saturation is a condition where the water holds greater than 100% of the expected maximum concentration of oxygen.

The dissolved oxygen concentration was low in the hypolimnion on the April and July sampling events. However, DO was high in the hypolimnion in June. As lakes/ponds age, oxygen becomes depleted in the hypolimnion by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment. Depleted oxygen concentration in the hypolimnion of thermally stratified lakes/ponds typically occurs as the summer progresses.

During this season, and the past three sampling seasons, the lake/pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion (the lower layer) than in the epilimnion (the upper layer). These data suggest that the process of internal phosphorus loading is occurring in the lake/pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion , the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. This oxygen depleted condition was witnessed in April and July, 2003.

pH and Acid Neutralizing Capacity (ANC)

Stevens Pond pH ranged from 6.61 to 7.26 and averaged 7.01. There was no significant change in pH between 2002 and 2003. ANC values ranged from 17.5 to 35.0 mg/L of CaCO. ANC averaged 29.2 mg/L of CaCO. Stevens Pond has a high buffering capacity. There was has been no significant change in ANC 2000.

Phosphorus (TP)

Total phosphorus levels in the hypolimnion ranged from .017 to .046 with an average of .027 mg/L. This is approximately 23% lower than 2002 hypolimnion TP levels, but still high in relation to healthier New Hampshire pond. High TP levels in the hypolimnion may indicate internal loading. Epilimnion TP levels ranged from .013 to .022 with an average of .017 mg/L. This is a slight decrease from 2002.

The historical data (see Figure 22) for the epilimnion show that the 2003 total phosphorus mean is *greater than* the state median. Overall, visual inspection of the historical data trend for the epilimnion shows a stable total phosphorus trend, which has been greater than the state median since monitoring began.

The historical data for the hypolimnion show that the 2003 total phosphorus median is much greater than the state median. It is important to note that the total phosphorus concentration in the hypolimnion, though varying slightly, generally increased steadily from April to September this year (same as 2002). This suggests that the process of internal phosphorus loading is occurring in the pond.

Overall, visual inspection of the historical data trend for the hypolimnion shows a stable (i.e. not changing) total phosphorus trend, which has been much greater than the state median since monitoring began.

Transparency

Secchi disk readings ranged from 1.9 to 4.2 and averaged 2.9 meters. As in past years, transparency did not appear to be greatly affected by chlorophyll-*a* content.

Overall, visual inspection of the historical data trend (see Figure 23) shows a steady trend for in-lake transparency since monitoring began in 2000.

As discussed previously, after at least 10 consecutive years of sample collection, we will conduct a statistical analysis of the data to objectively determine long-term trends in lake quality.

Turbidity

As expected, Stevens Pond turbidity values were highest in the hypolimnion. This may be caused by high levels of sodium and chloride in the bottom sediments. Hypolimnion turbidity ranged from 0.73 to 8.49 with an average of 3.68 (NTU). Epilimnion and metalimnion turbidity values averaged 2.63 and 2.07 respectively. These turbidity levels represent a decrease from 2002.

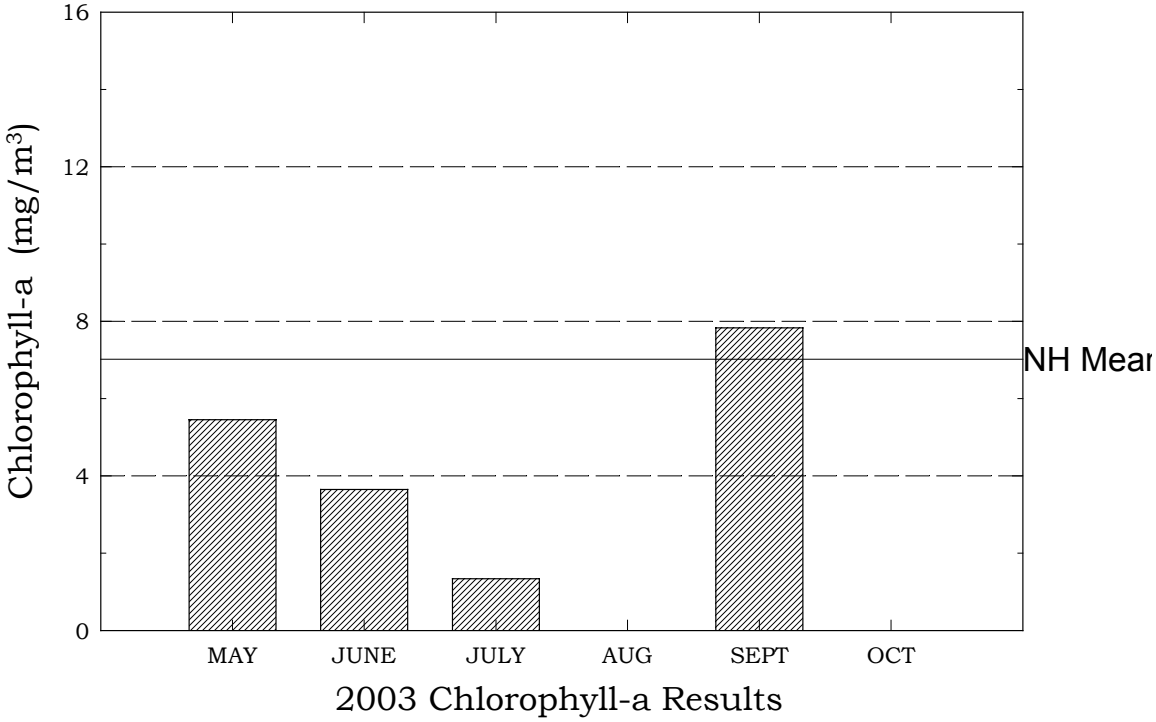
Table 8[1]
Comparison of Stevens Pond – 1981*, 1997, 2000 – 2003**

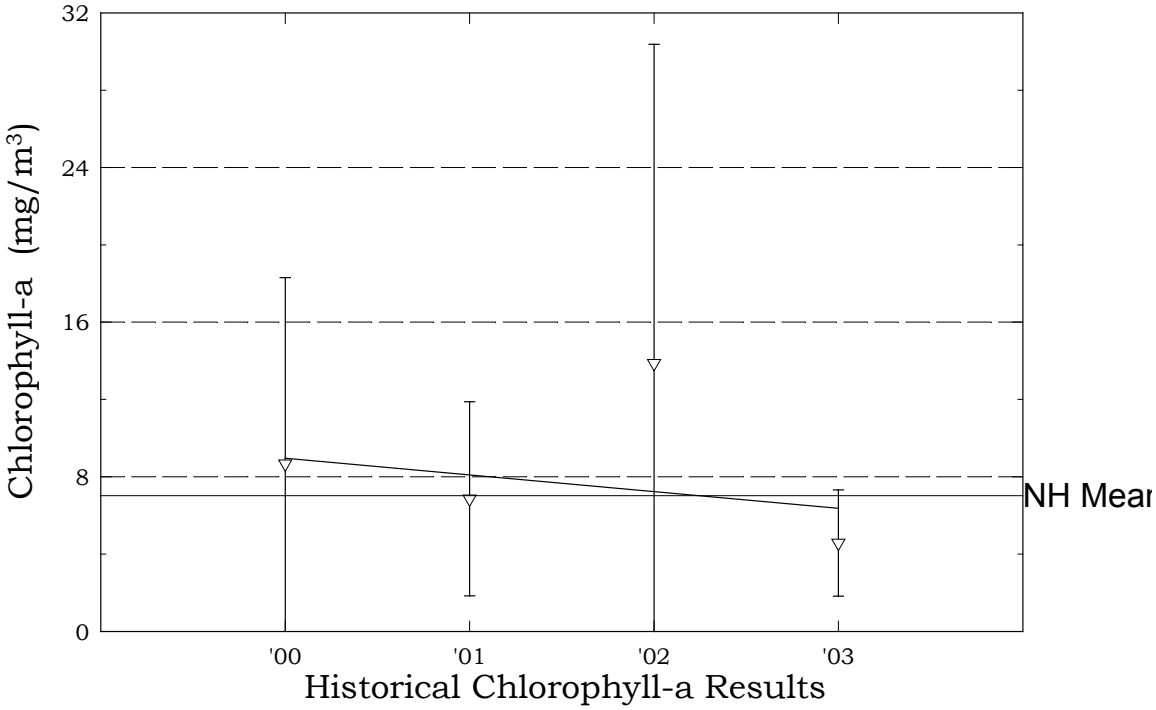
Parameter	7/29/81	7/23/97	2000 Mean	2000 Median	2001 Mean	2001 Median	2002 Mean	2002 Median	2003 Mean	2003 Median
pH	7.2	7.7	7.11	7.15	7.14	7.20	7.03	7.10	7.01	7.08
Alkalinity (mg/l)	33.0	31.8	34.2	34.8	31.0	32.7	30.78	31.4	29.2	31.6
Total Phosphorus (mg/l)	0.028	0.028	0.019	0.019	0.025	0.028	0.018	0.018	0.017	0.017
Conductivity (uMhos/cm)	301	696	769	765.5	1148.8	1128.0	1140.0	1102.0	1257.8	1229.5
Secchi Disk (m)	2.0	1.3	2.6	2.6	2.5	2.6	3.0	2.9	1.7	1.3
Chlorophyll-*a* (mg/m3)			8.68	4.08	6.26	4.60	10.32	3.20	4.28	3.65

1) All values are epilimnetic.
* NH Dept. of Environmental Services. 1981. Trophic Classification of NH Lakes and Ponds.
** NH Dept. of Environmental Services. 1998. Lake Trophic Data.

Stevens Pond, Manchester

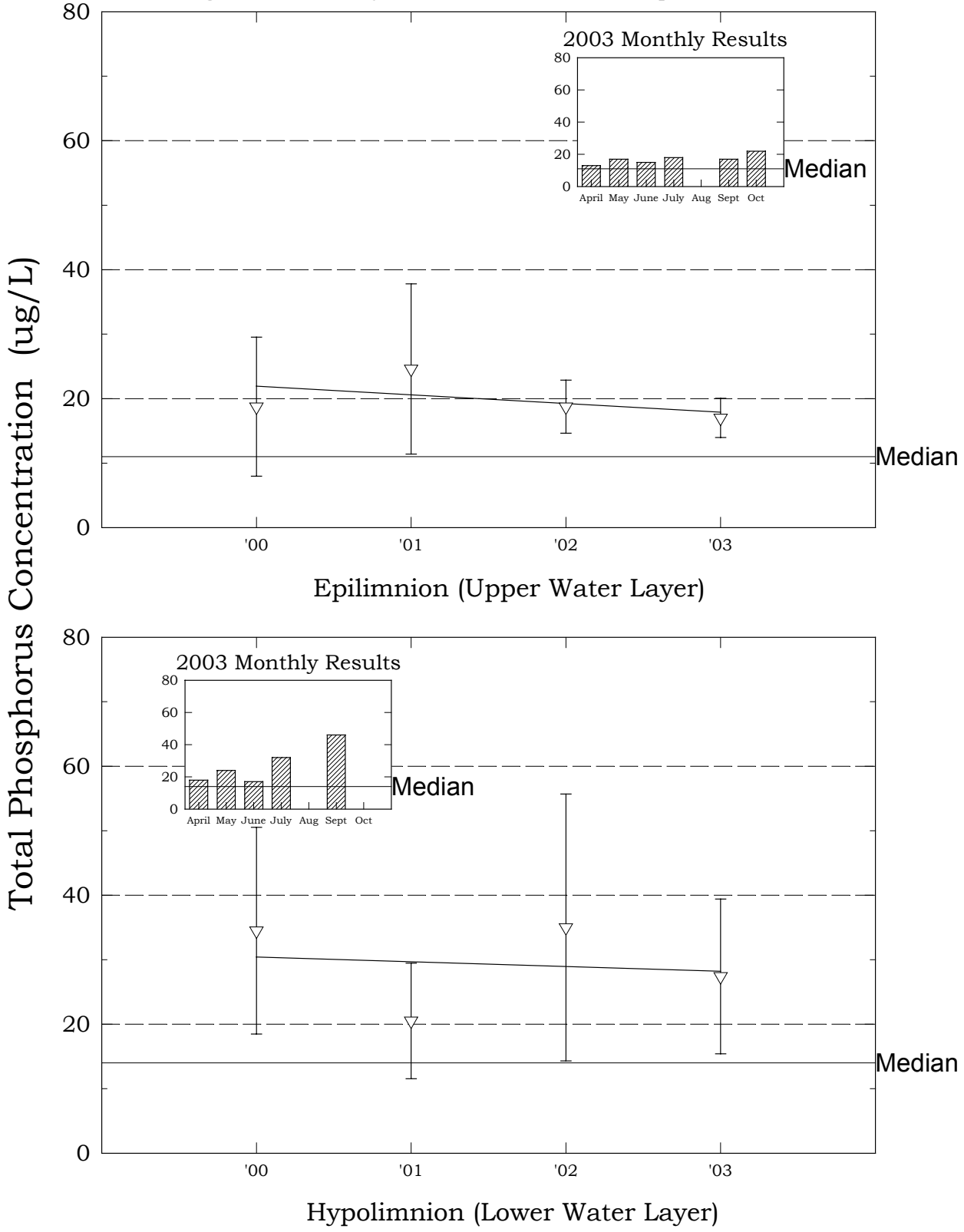
Figure 1. Monthly and Historical Chlorophyll-a Results





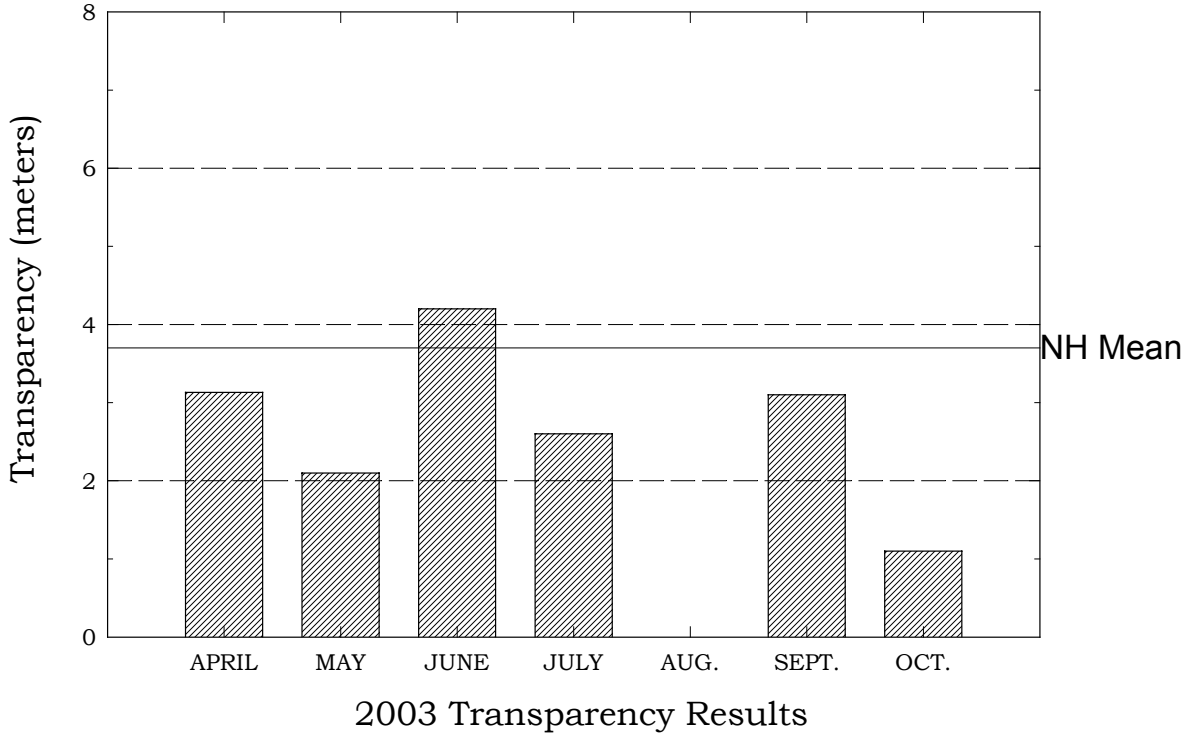
Stevens Pond, Manchester

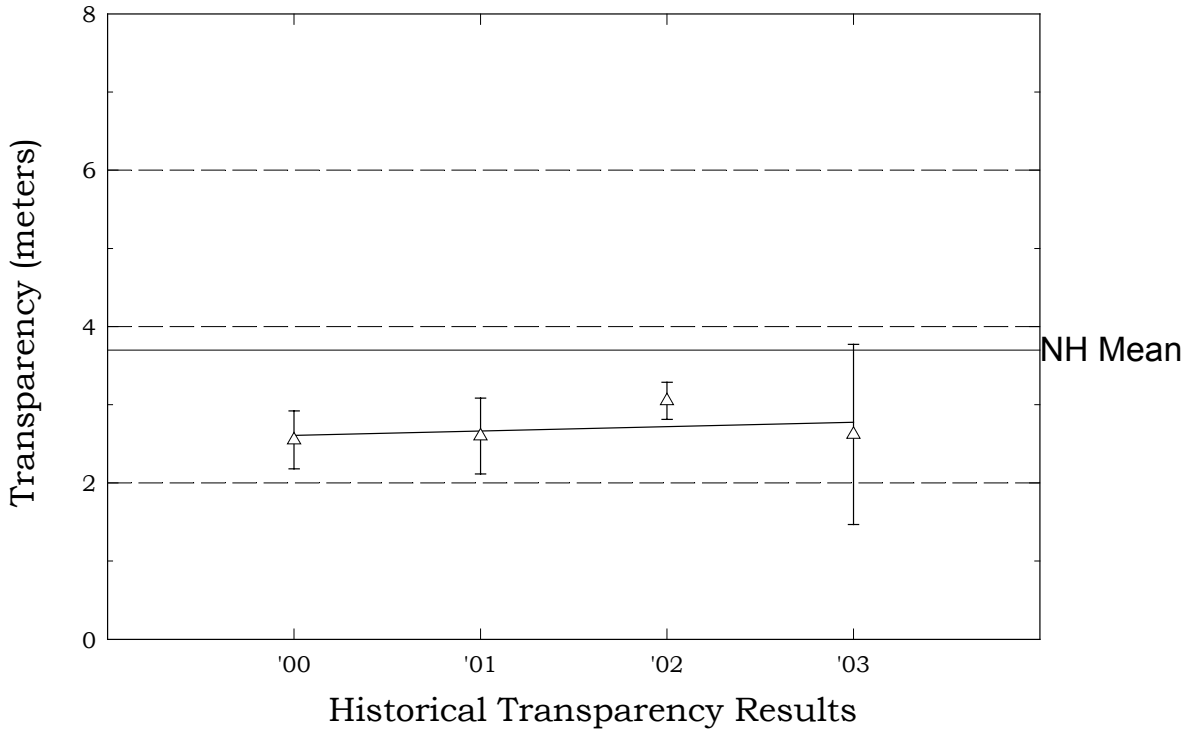
Figure 22. Monthly and Historical Total Phosphorus Data.



Stevens Pond, Manchester

Figure 23. Monthly and Historical Transparency Results





Section V. Pond Project Prioritization Status

Crystal Lake

Goal(s): To maintain fishable and swimmable water quality standards

Water Quality:

1) Address beach parking lot runoff/drainage issues.

2) Address Corning Rd runoff/drainage issues.

1994-1999: The health of Crystal Lake has been the focus of the efforts of the Crystal Lake Preservation Association (CLPA) since their inception in 1994. In 1999, the CLPA was awarded a grant from DES to install a new stormwater treatment system – the StormTreat system. This system now treats runoff from Bodwell Road and adjacent parking areas before it enters the lake. With this installation, one of only three surface water inlets is now being treated.

2002-2003: Comprehensive Environmental, Inc (CEI) was contracted through the SEPP to design plans to address items 1 & 2 above. The final design plans are now complete and are in the process of going out to bid for a contractor. These projects will include installation of best management practices (BMPs) at the two remaining outfalls that impact Crystal Lake. These outfalls contribute large amounts of sediment and nutrients to the lake during every rainfall. A series of catch basins drain the access road and parking area of the public beach and are connected to a culvert that outfalls at the north end of the beach. A sediment delta has developed here over the years. Preliminary plans have been designed to stabilize the shoulders of the access road with crushed stone and installation of proper drainage. Drainage of the parking area will also be improved. A grassed swale will be installed north of the parking area to treat the remaining runoff from the parking area.

The outfall that drains part of Corning Road is directly adjacent to a highly erodable steep slope. The slope contributes sediment that washes down Corning Road and into the drainage system. The slope also results in the necessity for intensive salt/sand treatment during winter months because of the high occurrence of icing on this section of road. These combined factors have formed a nutrient-rich sediment delta in the Lake at the point of the outfall.

At this location, a velocity-reducing device is proposed. Due to the steep slope of the area between Corning Road and the shoreline, a baffle tank is called for at the top of the drainage line. The two-baffle system will allow sediment to settle before continuing to the outfall. Installation of curbing along the south side of Corning Road will help prevent sediment eroding from the steep hillside from entering the drainage system.

3) Address *Phragmites* stand by chemical and mechanical treatments.

2003: Municipal Pest Management, Inc., has been working with UPRP to submit an application to the Department of Agriculture, Pesticide Board to spray Glyphosate (*Rodeo*) on the area in the growing season of 2004. The stalks from the dead plants will be cut above the ice during the winter and hauled away. The UPRP drafted and mailed a letter to abutters explaining the herbicide application process, and included a fact-sheet on *Phragmites* as well as one on Glyphosate.

4) Repair StormTreat System by adjusting headbox baffle wall.

Outreach/Education:

1) Continue providing educational materials in kiosk at beach.

2003: A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

2) Conduct native planting workshop to address intensely-maintained shoreland areas.

3) Provide *Phragmites* education to property owners.

2003: This was completed via an abutter mailing during the spring of 2003.

4) Provide Milfoil prevention education to property owners.

2003: This was completed via an abutter mailing during the spring of 2003.

Recreational:

1) Support project partner efforts to preserve and restore beach house and address parking situation.

2003: The Crystal Lake Preservation Association (CLPA) and For Manchester are working to address improvements to the beach house.

Land Preservation:

1) Support the advocacy of land conservation in areas where there is development pressure.

2) Provide careful consideration of land acquisition within the watershed.

2001-2003: CLPA has also been active in attempts to preserve certain tracks of land adjacent to the lake that are threatened by residential development. This area, known as the Filip's Glen subdivision, is the only remaining open space in proximity to the lake. It is important for the long-term health of the lake that this area be developed only in the most environmentally sensitive way possible. The CLPA was able to purchase property proposed for development. The developer has donated the largest wetland portion of the property to the CLPA. This particular portion is the closest to the lake of all the properties in question. A significant amount of the Urban Ponds Restoration Program budget has been allocated for the ultimate purchase and preservation of large portions of the Filip's Glen subdivision property to help preserve the water quality of Crystal Lake.

Other:

1) Enhance Watershed Management Plan

Crystal Lake. Photo by Art Grindle

Dorrs Pond

Goal(s): To restore fishable and swimmable water quality standards.

Water Quality:

1) Address tributary 2E runoff/drainage improvements.

2) Address tributary DP3 runoff/drainage improvements.

   2002: A grant was awarded to the Manchester Conservation Commission in January 2002 for a water quality improvement project on a tributary on the pond's east side. The DES grant, Section 319 local watershed initiative funds will pay for design and construction of a water quality improvement system in the East Inlet 2 (2E) drainage. The tributary collects runoff from approximately 66 acres of mixed-use land including a residential neighborhood and several large active commercial/industrial lots. The system will be designed to infiltrate as much storm water as possible and remove pollutants from runoff that does not get infiltrated. The project work is expected to take place during the summer and fall of 2004.

   During the fall of 2002, an environmental engineering firm, Comprehensive Environmental, Inc (CEI) was contracted to design plans to address items 1 & 2. The final design plans are now complete and are in the process of going out to bid for a contractor. The projects are expected to begin in 2004.

3) Perform wetland function study in the north end.

4) Perform possible sediment dredging in the north end to lessen nutrient load.

5) Address Goldfish Pond drainage by including outlet in regular sampling schedule and working with Hooksett Conservation Commission.

6) De-Channelize Ray Brook at outlet of Dorrs Pond

Outreach/Education:

1) Retrofit and provide educational materials in kiosk at Livingston Park.

   2003: A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

2) Provide fertilizer education through signage at kiosk.

3) Address duck feeding through signage in kiosk and on shore.

4) Address invasive species through signage at boat ramp and kiosk.

   2003: A sign has been placed at the boat ramp stating that Dorrs Pond is currently free of aquatic exotic plants and instructing boaters to remove all plant fragments from their boats to keep exotics out of the waterbody.

5) Address organic debris accumulation at dam through collaboration with Parks & Recreation.

   This item is completed annually by the Parks & Recreation Department.

Recreational:

1) Work with Parks & Recreation with trail/Parking lot enhancement projects.

Trail improvements are also underway around the pond. In 2001, the Manchester Parks Recreation and Cemetery Department received a grant from the Land and Water Conservation Fund to carry out a major trail improvement project at Livingston Park. The grant was matched by a private local fund. The improvement plan will consist of trail improvements, handicap accessibility through approximately 50% of the trail network, boardwalk and bridge construction and viewing areas with benches. Bridges will be installed over seasonal stream crossings lessening the likelihood of stream channel disturbance and erosion. The park parking lot will be served by a runoff treatment system to treat runoff before it exits into Ray Brook. This project should be finished by June 2004.

Land Preservation:

1) Support the advocacy of land conservation in areas where there is development pressure.
2) Provide careful consideration of land acquisition within the watershed.
3) Secure adjacent parkland through zoning/easements and possible creation of "Town Forest."

Dorrs Pond. Photo by Ron Johnson

Maxwell Pond

Goal(s): To assess the feasibility of dam removal and to conduct a habitat assessment.

Water Quality:

1) Conduct a dam removal feasibility study.
2) Address upstream sedimentation.
3) Address apartment complex runoff/drainage issues.
4) Assess habitat enhancement and support an increase of biodiversity.

2001-2003 : Plans are currently being discussed for possible dam removal at Maxwell Pond. In partnership with DES and Trout Unlimited (TU) the UPRP has been assisting with a feasibility study at Maxwell Pond to determine baseline conditions, and formulate hypotheses regarding the reaction of Black Brook to dam removal. Identification of existing channel location and conditions as well as historic, pre-dam channel characteristics is crucial to understanding the long term effects that dam removal may have on this site and the Black Brook corridor as a system. The dam removal feasibility study workplan includes aerial topographic surveying, stream channel morphology study, bathymetric survey and sediment depth mapping of Maxwell Pond, water quality monitoring of Maxwell Pond, and biomonitoring of Black Brook including macroinvertebrate surveys and fish surveys. If the dam is removed, approximately six miles of free-flowing stream would be restored.

Trout Unlimited was awarded a $13,850 grant from the DES local watershed initiative grant program in 2002 to conduct the first phase of the Black Brook corridor study, including photogrammetric mapping. This project produced an up-to-date aerial topographic map accurate to a contour interval of one foot.

Concurrent with the dam removal study, a restoration plan is being created for a disturbed site upstream of Maxwell Pond. A concrete aggregate and transportation operation has been impacting Black Brook for several years. Impacts include channel obstruction and filling as well as sedimentation and artificial bank armoring. The property owner has been cooperating with DES authorities to remedy the problems on the site, as well as to reconfigure stream crossings to allow proper fish passage and possibly relocate the stream channel to its historic location.

A Black Brook Advisory Committee (BBAC) has formed to take the project to the next level. City personnel from various commissions and departments as well as local citizens were called together to broaden the perspective of the project in 2003. A public informational meeting was held in 2003 and a meeting with the Board of Mayor and Aldermen to discuss the case for dam removal is scheduled for early 2004.

This project is supported by; the New Hampshire Fish and Game Department, the New Hampshire Department of Environmental Services, the New Hampshire River Restoration Task Force, and local chapters of Trout Unlimited, and the property owners; Wakefield Materials and the City of Manchester. Upstream abutters have expressed interest in the multi-year restoration initiative; several granted permission for the collection of geomorphic reference reach data on their property. The City of Manchester is contributing financially for the topographic survey and channel design work. Wakefield Materials is providing access to its property for the survey work, as well as material, equipment and labor. The NH Department of Environmental Services is providing ground control for the aerial survey and production of CAD-generated hardcopy topographic maps and funding for the bridge replacement. Volunteers from local Trout Unlimited chapters have assisted with the stream channel topographic surveys, electrofishing, collecting microinvertrabrates, riparian planting, and fry stocking.

Outreach/Education:

1) Construct and provide educational materials in kiosk at Blodgett Park.

2003: An Eagle-Scout constructed a kiosk at Wolfe Park in May 2003. A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the

waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the early summer of 2004.

2) Examine and address the threat of invasive species.

   2003: A partnership with the National Park Service and the New England Wildflower Society has developed and the workgroup is looking at invasive species management options on Maxwell Pond's southeast side.

Recreational:

1) Work with Parks & Recreation to construct a boardwalk and loop-trail around Maxwell Pond. This includes a small bridge over Black Brook.

2) Work with Parks & Recreation to install "debris" fencing along the northern side of the pond, adjacent to Manchester Gardens and other apartment complexes. Trash from nearby dumpsters is an increasingly big issue and should be addressed by installing a chain-linked fence or cedar, etc.

Land Preservation:

1) Secure adjacent parkland through zoning/easements.

Maxwell Pond Dam. Photo by Ron Johnson

McQuesten Pond

Goal(s): To secure conservation easements on private property adjacent to the pond.

Water Quality:

1) Long Term: Reduce pavement and restore shoreland in adjacent parking lots.

2) Short-Term: Advocate for on-site stormwater treatment systems.

Outreach/Education:

1) Construct and provide educational materials in kiosk at Wolfe Park.

2) Address invasive species through signage at kiosk and mailing to property owners.

3) Address duck feeding through signage at kiosk.

   2003: An Eagle-Scout constructed a kiosk at Wolfe Park in May, 2003. A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

4) Address adjacent dumpster & lot runoff through business mailings and site visits.

Recreational:

1) Construct a board walk at north end of pond.

Land Preservation:

1) Secure conservation easements on private property abutting pond.

   Ongoing: Since McQuesten Pond is largely privately owned, City funded conservation projects are not feasible at this time on most of the pond. The focus remains on obtaining easements or ownership from key property owners of the wetland and open water areas. In the mean time, conservation efforts will continue at the city-owned Wolfe Park side of the pond.

2) Investigate and consider potential for purchasing McQuesten Pond from the abutting landowners

Marty Gavin loads a dump truck with debris
from a cleanup at McQuesten Pond.
Photo by Art Grindle

Nutts Pond

Goal(s): To improve sport fishing and non-motorized/recreational boating opportunities. To improve water quality.

Water Quality:

1) Address urban runoff at four outfalls by completing a drainage study.

2) Investigate opportunities for NPS reduction in upper watershed areas.

3) Investigate opportunities to stabilize shoreline with native plantings.

2002-2003: During the winter of 2002 and 2003, Comprehensive Environmental Inc (CEI) conducted a nutrient budget study was conducted for the Nutts Pond watershed to help identify the worst pollution sources. The watershed was broken down into five subwatersheds and nutrient inputs were calculated according to land use types in each subwatershed. East Inlet subwatershed, the largest subwatershed area (more the 13 million square feet) was found to be the largest contributor of nutrients to the pond (58%). This subwatershed contains extensive athletic fields, large heavily used paved lots, extensive residential neighborhoods, and several strip malls. This area should be the focus for the first BMP installations at Nutts Pond. Recommendations for possible treatment measures are included in a memorandum report by CEI.

Currently, CEI is working on designs for BMP installation in the Precourt Park area. Since the Parks & Recreation Department is planning on improving Precourt Park in the coming year, it seemed timely to focus attention on water quality improvements on the Ponds north end at the same time. To incorporate BMP's into the original park facelift design will save unnecessary duplication of destruction and construction. The BMP design will attempt to divide stormwater volume and infiltrate as much flow as the site allows.

Outreach/Education:

1) Retrofit and provide educational materials in kiosk at Precourt Park.

2003: An Eagle-Scout retrofitted the kiosk at Precourt Park during May, 2003. A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

2) Provide outreach/education to area businesses through mailings and on-site pollution prevention assessments.

2002-2003: In 2002, the UPRP also created a pollution prevention business survey for facilities within the Nutts Pond watershed. From July through December 2003, 37 (out of 84) businesses in the Nutts Pond watershed were visited. These sites were chosen based on their proximity to Tannery Brook and Nutts Pond.

A few weeks prior to the visits, the businesses were mailed a letter explaining the project. During the visits, the store manager or facilities maintenance person was interviewed. Most businesses visited assessed on general information (whether they were aware of their proximity to Nutts Pond), solid waste/dumpster maintenance, floor drains, stormwater management, use oil, and use and/or storage of any other hazardous materials.

Most of the businesses were retail establishments that did not produce much solid waste and did not deal with any hazardous product storage or waste(s). All of the businesses surveyed were written a thank-you/follow-up letter, given suggestions for areas which needed improvement, and were also given an UPRP sticker for their window.

3) Address dumpster debris at Precourt Park through partnership with Parks & Recreation and Highway Department.

4) Address invasive species through signage at kiosk and at boat ramp.

2001: In 2001, Conservation Commissioner Jen Drociak found and identified Brazillian elodea at Nutts Pond. The Department of Environmental Services (DES) installed an informational sign at the boat launch during the summer of 2002 and has since mapped the area(s) of infestation.

2003: An aquatic herbicide was applied on the invasive plant stands during summer 2003. The UPRP has also posted in the kiosk on this matter.

Recreational:

1) Partner with Queen City Trails Alliance/Manchester Rails-To-Trails to enhance pond circuit trail.

2) Investigate use of and potentially improve boat-launch.

Lycott Lake and Pond Management applies an herbicide on Nutts Pond to control the invasive aquatic plant Brazillian waterweed *(Egaria densa)*. Photos by Jen Drociak

Nutts Pond Boat Ramp Signs.
Photo by Art Grindle

Brazillian Waterweed Sign at Nutts Pond. Photo by Art Grindle

Pine Island Pond

Goal(s): To maintain fishable and swimmable water quality standards and to improve fish habitat.

Water Quality:

1) Stabilize streambank at Cohas Brook.

2) Address sedimentation at Cohas Brook where it enters Pine Island Pond.

Outreach/Education:

1) Retrofit and provide educational materials in kiosk at Pine Island Park.

   2003: An Eagle-Scout retrofitted the kiosk at Pine Island Park during May, 2003. A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

2) Address accelerated plant growth through fertilizer education to property owners.

   2003: This was addressed by an educational direct mailing to pond abutters in 2003.

3) Address invasive species at Cohas Brook through volunteer maintenance efforts.

4) Support other entities to address boat wake issues.

Recreational:

1) Assess feasibility of fish ladder at dam with NHFG.

Other:

1) Develop Watershed Management Plan.

Pine Island Park at Pine Island Pond. Photo by Art Grindle

Stevens Pond

Goal(s): To improve water quality through a partnership with the New Hampshire Department of Transportation to address highway runoff.

Water Quality:

1) Address and remedy I-93 runoff issues.

   2001-2003: Since 2001, several agencies have been working on a solution to the highway runoff issue at Stevens Pond. The NH Department of Transportation has expressed willingness to work with DES and the UPRP to treat the highway runoff that is drastically affecting the water quality of Stevens Pond. Proposed solutions include a closed drainage system to divert stormwater to where adequate treatment can be attained, or a berm diversion system to separate the stormwater from Stevens Pond. Discussions with NH DOT are ongoing.

2) Address headwater erosion at EJ Roy Drive and other developed areas.

Outreach/Education:

1) Construct and provide educational materials in kiosk at boat launch.

2) Address invasive species with proper signage at kiosk and boat launch.

   2003: An Eagle-Scout constructed a kiosk at the Stevens Pond boat ramp during May, 2003. A series of color, laminated fact-sheets was created in 2002 and posted in the kiosk during the summer of 2003. These included a map of the waterbody/watershed, fact-sheets on the history of the waterbody, non-point source pollution issues, common exotic plants, and common fish. These were updated in November of 2003 and will be posted during the spring of 2004.

   2003: A sign has been placed at the boat ramp stating that Stevens Pond is currently free of aquatic exotic plants and instructing boaters to remove all plant fragments from their boats to keep exotics out of the waterbody.

Recreational:

1) Improve boat-launch.

2) Work with Parks & Recreational Department to create a wetland boardwalk.

3) Improve adjacent trails.

Land Preservation:

1) Secure adjacent parkland through zoning/easements.

Stevens Pond. Photo by Art Grindle

Appendix A. Fact-Sheets, Newsletters & Surveys

Pond Possibilities

The Newsletter of the Manchester Urban Ponds Restoration Program Volume 4

Urban Ponds Restoration Program Posts Watershed Signs Within The City

On November 19, 2002, Mayor Robert Baines accompanied Art Grindle (Urban Ponds Restoration Coordinator – pictured at right) in posting the first "watershed" sign within the City. Manchester has seven urban waterbodies, and approximately 30 signs will be posted within the City during this spring. The signs will be posted in visible areas surrounding each of the ponds. "This endeavor will serve as a friendly reminder that our actions on land ultimately affect nearby waterbodies…thus causing a "watershed" effect" stated Art Grindle. "We also hope that people will become more familiar with these waterbodies and the surrounding land use."

Unlock The Information: UPRP Website Unveiled!

In an attempt to educate more people in the city of Manchester, members of the Conservation Commission coordinated with the Urban Ponds Restoration Program (UPRP) liaison to develop an informative and interactive website devoted to the City's seven urban waterbodies.

The Urban Ponds Restoration Program webpages includes watershed maps, water quality data, vegetation inventory data, fish tissue results, and sediment sampling data for all ponds. In addition, the site hosts several biological "fact-sheets," posters, and other publications such as this newsletter. Lastly, the site features a calendar of volunteer opportunities, and outreach/education events.

Visit http://www.ci.manchester.nh.us/UrbanPonds and unlock the information on your favorite pond! awarded a similar grant in 2002 for tributary work at Dorrs Pond.

UPRP Awarded Watershed Restoration Grant

The New Hampshire Department of Environmental Services recently awarded the UPRP $73,482 for Crystal Lake Water Quality Improvement Projects, implementing stormwater BMPs designed by CEI at the beach and along Corning Road.

Inside This Issue

News & Notes

Mark Your Calendars, Grab Your Hipboots: The UPRP Seeks Volunteers For Spring Cleanups!

It's that time of year again! The UPRP once again seeks volunteers for the annual spring "clean-ups." The following Saturdays and locations have been designated:

April 12 – Nutts Pond (Rain date 4/19)
(Meet in Precourt Park near kiosk)

May 3 – Dorrs Pond (Rain date 5/17)
(Meet in parking lot)

May 17 – Maxwell Pond (Rain date 5/24)
(Meet in parking lot)

May 31 – McQuesten Pond (Rain date 6/14)
(Meet in parking lot behind Mallard Plaza)

June 7 – Stevens Pond (Rain date 6/14)
(Meet at boat ramp)

Each cleanup will be held from 9-12:00 but volunteers are not obligated to stay the entire time. Rakes, garbage bags, and gloves will be provided. Just bring yourself, a friend, and your community spirit of volunteerism! We look forward to meeting you, and greatly appreciate your assistance!

Other Events

Saturday April 12 – "**Adopt A Block**" Manchester
Thursday April 24 – Environmental Forum (5-9pm at PSNH Headquarters, Manchester)
Saturday April 26 – **"Discover Wild NH Day"** (10-3pm at NH Fish & Game Dept, Concord NH)
Saturday May 3 – **"Amoskeag Fishways Carnival"** (10-4pm) Visit the UPRP Display & Activities!

A NOTICE TO ALL JUNIOR HIGH, HIGH SCHOOL AND COMMUNITY COLLEGE TEACHERS:

The UPRP is available to present the program, its goals, water quality sampling, and outreach/education endeavors. Invite us to your classroom and hear and interactive presentation! We also available to lead field trips to area ponds! Contact us!

Pond Possibilities

Pond Possibilities is a bi-annual publication of the Manchester Urban Ponds Restoration Program.

Art Grindle – **Program Coordinator**

Jen Drociak – Editor & Contributing Writer

Conservation Commissioners
Michael Poisson - Eric Skoglund
Jen Drociak - JoAnn O'Shaughnessey
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http://www.ci.manchester.nh.us/UrbanPonds

Pond Possibilities

The Newsletter of the Manchester Urban Ponds Restoration Program
Fall 2003

The Results Are In! Manchester Residents Provide Feedback via Watershed Surveys

This spring, the UPRP conducted a public awareness survey to better understand public attitudes toward Manchester's urban ponds. With assistance from of the UNH Survey Center, we designed the survey to tell us what people know about the ponds, and how they feel they have changed over the years. The survey consisted of 14 questions. We asked people to describe the condition of the ponds (polluted, clean, etc.), and to rate the effectiveness of several possible solutions. We also asked questions relative to wildlife and volunteer opportunities. 2,000 surveys were sent to a randomly selected sample of registered Manchester voters. We received 350 responses. Here is what you told us:

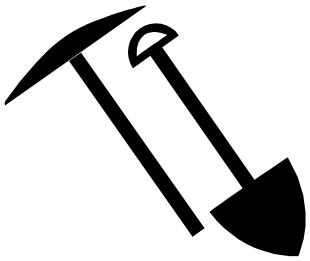
The majority of respondents know the location of 5 of the 7 urban ponds. The same majority however, do not know the locations of Maxwell or McQuesten Ponds.

- Only 25% of respondents had heard of the UPRP before the survey.
- 69% of respondents know what a watershed is.
- 28% of respondents think that Manchester's urban ponds are polluted or very polluted.
- 91% of respondents think the ponds are very valuable or somewhat valuable for wildlife
- 80% of respondents think the ponds are very valuable or somewhat valuable for recreation.
- 70% of respondents have lived in Manchester for more than 20 years and almost half of respondents were between 40 and 59 years old. The smallest age bracket represented was 18-29 year olds at 4%.

The survey will be repeated next spring to determine any changes in public awareness as a result of the UPRP's efforts.

Projects Underway at Crystal Lake & Dorrs Pond

Comprehensive Environmental Inc. (CEI) has completed engineering plans for the UPRP's first "in-the-ground" projects. These projects include water quality improvement structures at Crystal Lake and Dorrs Pond.



The structures at Crystal Lake will address nutrient and pollution runoff from Corning Road and the City Beach parking area. At Dorrs Pond, improvements will be made to the tributary that collects runoff from an area of D.W. Highway including several commercial sites and many residences. Pending NHDES Wetlands Board approval, the projects will be put out to bid this winter for spring construction.

All three of the projects are being partially funded by grants from NH DES, which the UPRP was awarded in 2002 and 2003.

Spring Pond Cleanups Successful!

In a series of spring cleanups, 20 volunteers assisted staff from the UPRP collect and properly dispose of over 69 bags of trash at five ponds! As expected, the most heavily degraded of the ponds were Nutts and McQuesten, respectively. 33 of the 69 bags of trash were from Nutts Pond, and 2,680 pounds of trash was removed from the vicinity of McQuesten Pond. On the contrary, the cleanest of the ponds were Dorrs Pond, with only 6 bags of trash collected, and Maxwell Pond, with only seven.

What was collected from these ponds? Disposable items such as plastic bottles, food wrappers, and containers were among the usual, as well as items (in which people refuse to pay to properly dispose of) such as car tires, car batteries, other automotive parts, large electronics and furniture. Volunteers also collected other items such as 2 shopping carts, 7 tires, 1 park bench, 1 kayak, 12 pieces of lumber, 1 broken duck box, 3 auto parts, chairs, stools, tables, wood, and metal pieces.

To our surprise, the debris in the vicinity of McQuesten Pond appeared to come from mostly from adjacent businesses. Volunteers found a large pile of construction debris consisting of flooring tile, sheetrock, and plaster materials, as well as wall-framing lumber, metal doorways, doors, tables, chairs, lumber, and other debris. In addition, a large cable wheel and heating oil tank were found in the wetland itself. It was obvious that dumpsters from area businesses were not being emptied, and non-disposable materials were being stockpiled. The UPRP is working with area businesses to remedy this issue.

UPRP would like to individually thank the following volunteers who took time out of their busy schedules to assist with spring pond cleanups:

Emily Burr
Christos Chakas
Andy Chapman
Heidi Clark
Christa Elliott

Rita Espinosa
Marty Gavin
Liz Gestude
Louella Grindle
Tabitha Grindle

Blanche Grondin
Pete Martineau
Lowell McPherson
Candace Puchaz
Carolyn Puchaz

Scott Shepard
Steven Smith
Phyllis Stewart
Gail Trimbur
Steve Viggiano

Fall Clean-Up Schedule

Each cleanup will be held from 9-12:00 but volunteers are not obligated to stay the entire time. Rakes, garbage bags, and gloves will be provided. Just bring yourself, a friend, and your community spirit of volunteerism! We look forward to meeting you, and greatly appreciate your assistance! The fall cleanup schedule is as follows:

Dorrs Pond – September 13

Maxwell Pond – September 20

Nutts Pond – October 4

Stevens Pond – October 11

McQuesten Pond – October 18

Yard Waste Collection Reminder

This message is to remind you not to dump your yard waste (leaves, lawn clippings, weeds, tree branches, sawdust, compost, etc) on the City parkland adjacent to the ponds. This practice is unlawful and harmful to water quality. The City Highway Department provides a free, bi-weekly curb-side collection service on the day that your recycling is collected. Containers marked with an orange "Yard Waste" stickers and/or paper lawn bags are acceptable. To obtain free stickers, or for more information on collection schedules, contact the Highway Dept at 624-6444 or www.manchesternh.gov/CityGov/DPW/HWY/Home.html

Outreach & Education Endeavors

News

On April 7th, Jen Drociak and Art Grindle presented the UPRP to two **freshman ecology classes at St. Anselms**. They presented an overview of the program, biological and water quality monitoring, outreach and education endeavors, and some of the projects being used to curb further degradation to our urban ponds. **Over 100 students** were at the **lecture**, and many of them accompanied Art to Nutts Pond for a hands-on **field trip** and **trail walk**. A total of **122 UPRP brochures and 96 SEPP brochures were distributed** at this time.

On April 24th, Jen Drociak and Art Grindle spoke at the first annual "**Manchester Earth Day Forum"**, which was held at the new PSNH Energy Park. The event gathered **over 100 attendees**, and was a successful event. In fact, **204 UPRP fact-sheets were distributed** and the program peaked the interest of many people. Many SEPP project partners were in attendance, and speakers and organizers of the event included The Nature Conservancy, For Manchester, Merrimack River Watershed Council, Amoskeag Fishways, Camp Dresser & McKee, Manchester Health Department, Hands Across the Merrimack, Manchester Conservation Commission, EPA New England, Manchester Water Works, Manchester Parks & Recreation, Manchester Department & Community Development, Manchester Department of Public Works, Voices & Choices, Queen City Trails Alliance, UNH Cooperative Extension, and Friends of the Valley Cemetery.

On May 3rd, Jen Drociak was an exhibitor at the Amoskeag Fishways **"Fabulous Fishways Carnival."** Jen was among several exhibitors including DES Rivers Management Program, the Nature Conservancy, NH Fish & Game, Audubon Society and many local river advisory committees. Jen spoke to many people and talked about the Urban Ponds Restoration Program and local ecology at the ponds. **121 fact-sheets were distributed**.

On June 21st, Jen Drociak spoke at the **NH Lakes Association's Annual Congress**. Her presentation was entitled **"At the End of the Pipe: Issues & Impacts Associated With Urban Waterbodies."** Though only a handful of people attended this session, it was well-received. Senator Judd Gregg was at the event and heard about the efforts of the UPRP.

New: Informational Kiosks at Each Pond

This spring, with help from Eagle Scout Aaron Biedrzycki, three kiosks were constructed and three others were updated. There are not kiosks at each pond. Jen Drociak, Art Grindle, and 2002 intern Lydia Henry created several maps, posters, flyers, and fact-sheets for the kiosks including information on Common Exotic Plants, Common Fish, History fact-sheets and notices on nonpoint source pollution. The UPRP would like to extend a big **THANK YOU** to Aaron and his crew for assisting us with this long-overdue endeavor!

Notices

A Notice To All Junior High, High School And Community College Teachers:

The UPRP is available to present the program, its goals, water quality sampling, and outreach/education endeavors. Invite us to your classroom and hear and interactive presentation! We also available to lead field trips to area ponds! Contact Jen Drociak at (603) 647-1826 or e-mail urbanponds@yahoo.com

Pond Possibilities Now Available Electronically

Would you like to receive this publication electronically instead? The UPRP now has an electronic newsletter mailing list, and Pond Possibilities can be sent to you in PDF format. If you would rather receive this mailing electronically, please send an e-mail to Jen Drociak at urbanponds@yahoo.com

Pond Possibilities

Pond Possibilities is a bi-annual publication of the Manchester Urban Ponds Restoration Program.

Art Grindle – **Program Coordinator**

Jen Drociak – Managing Editor

Conservation Commissioners
Michael Poisson – Eric Skoglund
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Kathleen Neville – Todd Connors
Marty Gavin

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http://www.ci.manchester.nh.us/UrbanPonds

New On Our Website

Visit http://www.ci.manchester.nh.us/UrbanPonds to find a new list of educational and project partner links, and downloadable publications created by the Urban Ponds Restoration Program.

Volunteer Appreciation Event

Over the last four years, the Manchester Urban Ponds Restoration Program has enlisted the help of dozens of volunteers to assist with water quality sampling, nonpoint source pollution shoreline surveys, outreach/education endeavors, and bi-annual cleanups at each of the seven ponds.

As a token of our gratitude, we are planning a volunteer appreciation barbeque and end-of-season program wrap-up. This event will include a presentation on the UPRP including a program overview, obstacles, success stories to date, and future endeavors. Complimentary brochures, fact-sheets, and other publications will be available. Stay tuned for more information!

Manchester Urban Ponds Restoration Program
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Manchester, NH 03101
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http://www.ci.manchester.nh.us/UrbanPonds

Mail To:

MANCHESTER URBAN PONDS RESTORATION PROGRAM SURVEY

Dear Resident of Manchester:

This survey is designed to provide a better understanding of the public awareness level concerning the environmental conditions of several urban ponds in Manchester, and also how people feel about the ponds in general. Please take a few minutes to complete this brief survey and be assured that your answers are confidential. For each question please circle the appropriate number that best represents your opinion. When completed, please use the enclosed business reply envelope to return the survey. Thank you, in advance, for taking the time to complete this survey. The input of Manchester residents such as yourself is vital to the success of this research. **Please complete and return the survey as soon as possible.**

Art Grindle - UPRP Coordinator, City of Manchester, NH

PUBLIC AWARENESS

1. Manchester has seven urban ponds, listed below. Please indicate whether or not you know the location for each, and whether or not you have visited each.

	Know Location?		Visited?	
	Yes	No	Yes	No
Crystal Lake	1	2	1	2
Dorrs Pond	1	2	1	2
Maxwell Pond	1	2	1	2
McQuesten Pond	1	2	1	2
Nutts Pond	1	2	1	2
Pine Island Pond	1	2	1	2
Stevens Pond	1	2	1	2

2. Had you heard of the Urban Ponds Restoration Program prior to this questionnaire?

1Yes 2 No

3. Do you know what a "watershed" is?

1 Yes 2 No

CURRENT WATERBODY CONDITIONS

4. How would you describe the condition of Manchester's urban ponds, in general?

Very Polluted	Polluted	Fair	Clean	Pristine	Don't Know
1	2	3	4	5	0

5. Please rate how serious you think each of the following issues are concerning these ponds.

	Not Serious	Somewhat Serious	Very Serious	Don't Know
Algae/aquatic plants	1	2	3	0
Erosion	1	2	3	0
Illegal dumping/litter	1	2	3	0
Increased development	1	2	3	0
Invasive plant species	1	2	3	0
Habitat destruction	1	2	3	0
Heavy metals	1	2	3	0
Poor recreational opportunities	1	2	3	0
Water level	1	2	3	0
Unsafe neighborhoods	1	2	3	0
Urban runoff	1	2	3	0

FUNCTIONS AND VALUES

6. How valuable do you think the ponds are for wildlife?

Very Valuable	Somewhat Valuable	Neutral	Not Very Valuable	Not At All Valuable	Don't Know
1	2	3	4	5	0

7. How valuable do you think the ponds are for recreation?

Very Valuable	Somewhat Valuable	Neutral	Not Very Valuable	Not At All Valuable	Don't Know
1	2	3	4	5	0

8. Have you engaged in any of the following recreational activities at any of Manchester's urban ponds in the past year?

	Crystal Lake	Dorrs Pond	Maxwell Pond	McQuesten Pond	Nutts Pond	Pine Island Pond	Stevens Pond	Don't Do This Activity
Bird watching	1	2	3	4	5	6	7	0
Canoe/kayak	1	2	3	4	5	6	7	0
Fishing	1	2	3	4	5	6	7	0
Picnic	1	2	3	4	5	6	7	0
Swimming	1	2	3	4	5	6	7	0
Walk/jog the trails	1	2	3	4	5	6	7	0
Other – *Please specify:*	1	2	3	4	5	6	7	

POSSIBLE SOLUTIONS

9. How useful do you think each of the following possible solutions would be in addressing the issues facing Manchester's urban ponds?

	Not Useful	Somewhat Useful	Very Useful	Don't Know
Restrictions on new development near ponds	1	2	3	0
Treating or eliminating urban run-off	1	2	3	0
Restricting public access	1	2	3	0
Volunteer conservation efforts	1	2	3	0
Altering wildlife habitat	1	2	3	0
Chemical treatments	1	2	3	0
Other – *Please specify:* _____	1	2	3	

10. How interested would you be in volunteering for the following possible events or activities?

	Not Interested	Somewhat Interested	Very Interested	Not Sure/ Need Info.
Litter clean-up events	1	2	3	0
Water quality monitoring	1	2	3	0
Outreach/education efforts	1	2	3	0
Conservation project work	1	2	3	0
Other – *Please specify:* _____	1	2	3	

DEMOGRAPHICS

11. How many years have you lived in Manchester?

_____ years

12. What ward do you live in?

_____ (1 through 12)

13. Which of the following includes your age?

18 - 29	30 - 39	40 - 59	60 or older
1	2	3	4

14. What is the highest level of education you have completed? (Please circle one only.)

1 Some high school
2 Graduated high school
3 Some college
4 Bachelor's degree
5 Advanced degree

Thank you for your participation!

If you would like further information, please contact Art Grindle (Program Coordinator) at 624-6450 or agrindle@ci.manchester.nh.us

To be placed on the Urban Ponds Restoration Program mailing list, please fill out the information below:

Name: _____

Street: _____

Phone: _____

Email: _____

Manchester Urban Ponds Restoration Program
Pollution Prevention On-Site Assessment Survey

Name of Business: _____ Contact: _____

Assessed By: _____ Date: _____

Section 1: General Information

1. What type of business is this? _____
2. Are you aware this facility is in the Nutts Pond watershed? Y N
3. Does this facility have an aboveground storage tank? Y N
4. Does this facility have an underground storage tank? Y N
5. Is there noticeable trash/litter around the property? Y N

Section 2: Solid Waste/Dumpster Maintenance

1. Is there a dumpster on site? Y N
2. What types of waste are disposed of in the dumpster? _____
3. What is the distance of dumpster to the nearest swale, catch basin, or stream? _____
4. Is the dumpster overflowing? Y N
5. How often is the dumpster emptied? _____
6. Is the dumpster lid kept closed? Y N
7. Is there a better location for the dumpster? Y N
   If so, where? _____
8. Does this facility recycle? Y N
9. If so, how often are the recyclables picked-up or dropped-off at a transfer station?
   _____
10. Does this facility safely store mercury-containing fluorescent bulbs? Y N
11. Does this facility recycle mercury-containing fluorescent bulbs? Y N

Section 3: Floor Drains

1. Are there floor drains at this facility? Y N
2. Are the floor drains sealed? Y N
3. Are the floor drains connected to a registered holding tank? Y N
4. Are the floor drains connected to a municipal sewer system? Y N
5. What is discharged to the drains? _____

Section 4: Stormwater Management

1. Does the site have adequate drainage? Y N
2. What type of drainage device does your facility have? (Catch basins, Culverts, Swales, Stormwater Treatment Devices) _____
3. If this facility has catch basins, how often are they cleaned? _____
4. Do the storm drains overflow during rainstorms? Y N
5. Does this facility minimize the amount of impervious (paved) areas outside? Y N
6. Does this facility maintain buffer strips between surface waters and upland areas? Y N
7. Are there lawns on site? Y N
8. If so, are the lawns fertilized? Y N
9. Does this facility soil test before fertilizing? Y N
10. Are pesticides/insecticides used anywhere on the property? Y N
11. How often is the parking lot swept? _____

Section 5: Outdoor Storage of Products or Hazardous Wastes

1. Are Products or Hazardous Wastes are stored outdoors? Products Wastes N/A
2. If so, what types of materials are being stored? _____
3. Are these materials being stored on an impermeable surface? Y N
4. Are these materials protected from the elements? Y N
5. Is there any noticeable leakage from the containers? Y N

Section 4: Cleaning Products

1. What type of cleaning products does this facility utilize? _____

Section 5: Used Oil (For Automotive Facilities Only)

Does this facility:
1. Store used oil in structurally sound containers? Y N
2. Recycle Used Oil? Y N
3. Keep containers closed and sealed except when oil is being added or removed from the container or tank? Y N
4. Have a used oil burner? Y N
5. Properly drain and dispose of used oil filters? Y N
6. Recycle used oil filters with a scrap metal dealer? Y N
7. Own a filter crusher? Y N

Section 6: Parts Washing & Absorbents (For Automotive Facilities Only)

1. Does this facility use absorbents that are wringable and reusable? Y N
2. Does this facility use a laundering service? Y N
3. Does this facility have a parts washer? Y N
4. How often does this facility change the solvent? _____
6. How often does the solvent get disposed of? _____
7. How does this facility dispose of soiled rags? _____

Section 7: Lead-Acid Batteries & Antifreeze (For Automotive Facilities Only)

Does this facility:
1. Safely store used lead-acid batteries? Y N
2. Recycle spent lead-acid batteries? Y N
3. Store used antifreeze in structurally-sound, clearly-marked containers? Y N
4. Recycle used antifreeze? Y N

Section 8: Vehicle Washing (For Car Washing Facilities Only)

1. Does this facility perform vehicle washing _____outside or _____inside?
2. If outside, are vehicles washed on an _____impervious or _____pervious surface?
3. What type of cleaning agent does this facility use? _____
4. Where does runoff from this operation go? _____

Section 9: (**For Supermarkets Only)**

1. How is excess food waste disposed of? _____
2. How is cooking oil or other material disposed of? _____

Section 10: (For Animal Care Facilities Only)

How is animal waste disposed of? _____

Appendix C:

Manchester Urban Ponds Restoration Program
Pond Sampling Procedure
Based on NH VLAP Protocol

General

1. All bottles must be labeled with: pond name, city, date, time, and sample description.
2. Locate the deepest spot in the pond using map provided. Drop anchor and verify with depth finder.

Dissolved Oxygen/Temperature Profile:

1. Inspect the probe membrane. No are bubbles should be present.
2. Turn the unit on (set knob to "calibrate"). The YSI 52 Meter will perform a self-check. Moisten the sponge in the cap on the DO probe. Reattach the cap leaving a small space between the sponge and the probe. Press confirm when prompted. Press confirm again when "Enter cal value Last = 100%" appears. The meter will indicate when calibration is complete.
3. Take surface reading (submerge the probe just under the water's surface). Record on data sheet.
4. Take readings at each meter to within 1 meter of the bottom. Record these on the data sheet.
5. Take note of temperature readings that differ by more than 1 degree celcius between meters. Once a significant temperature drop is observed, the temp. will continue to fall meter by meter until the temp. levels off. The first point where the temp. drops by 1 degree or more is the bottom of the top water layer (*epilimnion*). The point where the temp. levels off after steadily dropping is the bottom of the middle layer (*metalimnion* or *thermocline*). The bottom layer is the *hypolimnion*. Identify the midpoint depth of each layer and record this on the data sheet in the area labeled "sample depths".

Kemmerer Bottle:

1. Using the Kemmerer Bottle, collect samples from the midpoint of each water layer. These samples are placed in the large white (opaque) bottles. Be sure to rinse these bottles with pond water before filling. Also fill the small brown bottles using these samples (do not rinse these bottles; contain strong acid preservative).

Composite Sample:

1. Rinse the bucket with lake water and discard over side of boat.
2. Take one Kemm. Bottle sample at each meter beginning at the midpoint of the middle layer and working up to 1 meter. If the pond is not stratified, start at 2/3 of the pond depth and work up to 1 meter.
3. Empty half of the Kemm. Bottle sample from each depth into the bucket and discard the rest. Mix well.
4. Rinse the large brown bottle with water from the bucket and discard. Then fill the bottle to the top. Label the bottle "____M Comp" indicating the deepest point at which the composite was started.

Plankton Sample:

1. Collect a sample of plankton using the plankton net.
2. Be sure the clamp is closed at the net outlet. Lower the net to the midpoint of the middle layer and retrieve slowly and steadily. When net reaches the surface rinse the plankton down the sides by dipping the net repeated, being careful not to submerge completely.
3. Raise the net from the water and gently swirl it in a circular fashion to concentrate the plankton.
4. Empty the contents into one of the glass bottles by releasing the clamp on the hose at the bottom of the net. Close the clamp when finished.

5. Lower the bottom portion of the net into the water, raise and swirl again. Release the clamp and empty contents into the same glass bottle. This rinses remaining plankton off the net, and into the sample.

6. Repeat steps 2 through 5. This time add three drops of Lugall's solution (brown liquid in the small glass vial) to the second sample and slightly agitate the sample. The correct amount of Lugall's solution should make the sample tea-colored.

7. Label both glass bottles "____M Vert" indicating the depth at which you started the haul.

Secchi Disk:

1. Lower the secchi disk over the shady side of the boat until it disappears from sight.

2. Slowly raise the disk until the white is just visible. Note the depth at which this occurs. Record the average of these two points.

3. Repeat this process yourself, or by another monitor. Record both transparency readings on the Field Data Sheet, then calculate the average.

Inlet & Outlet Sample Collection:

1. At each designated inlet and outlet fill a large white bottle and a small brown bottle.

2. Label these bottles "_____ Inlet", or "_____ Outlet".

3. Be sure the water is flowing. Samples should not be taken from a stream that is stagnant. Be careful not to agitate the water upstream from where the sample is to be obtained.

4. Rinse the white bottle using stream water and discard rinse water downstream from sample location.

5. Collect sample by dipping the white bottle under the surface, being careful not to disturb the bottom.

6. Fill the small brown bottle to the neck with water from the white bottle. **Do not** rinse the small brown bottles.

7. Dip the white bottle again to refill.

Complete the Field Data Sheet (observations, stream flow, etc.). Store samples in a cooler with ice and transport to Concord DES Laboratory **within 24 hours**. Be sure the samples arrive in time to be analyzed that day (**before 2:00 PM**).

Appendix D: Water Quality Data Tables

Appendix E: Glossary